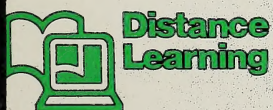


BIOLOGY 20

Matter and Energy in Humans

Module 6



Alberta
EDUCATION



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Module 6

Matter and Energy in Humans



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Module 6
Matter and Energy in Humans
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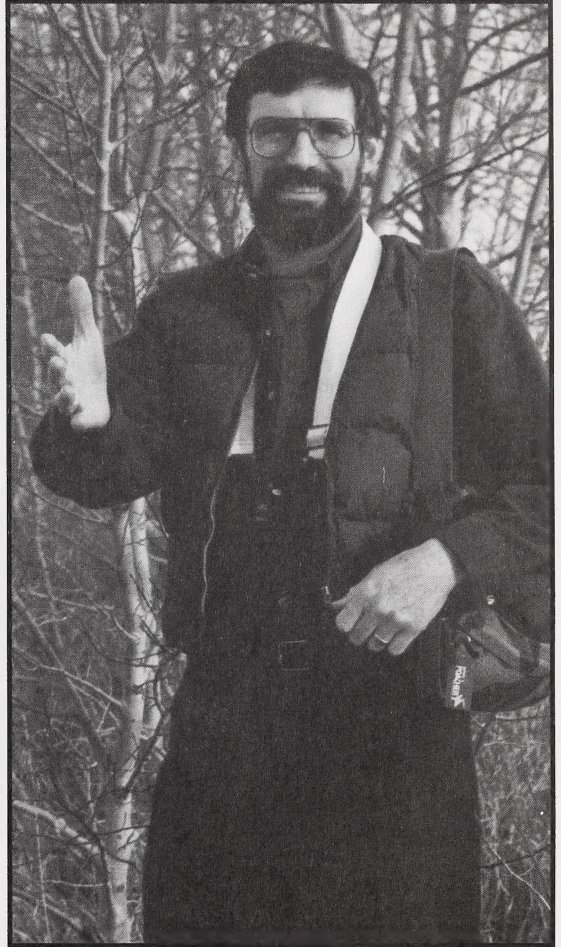
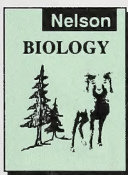
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Welcome to Module 6

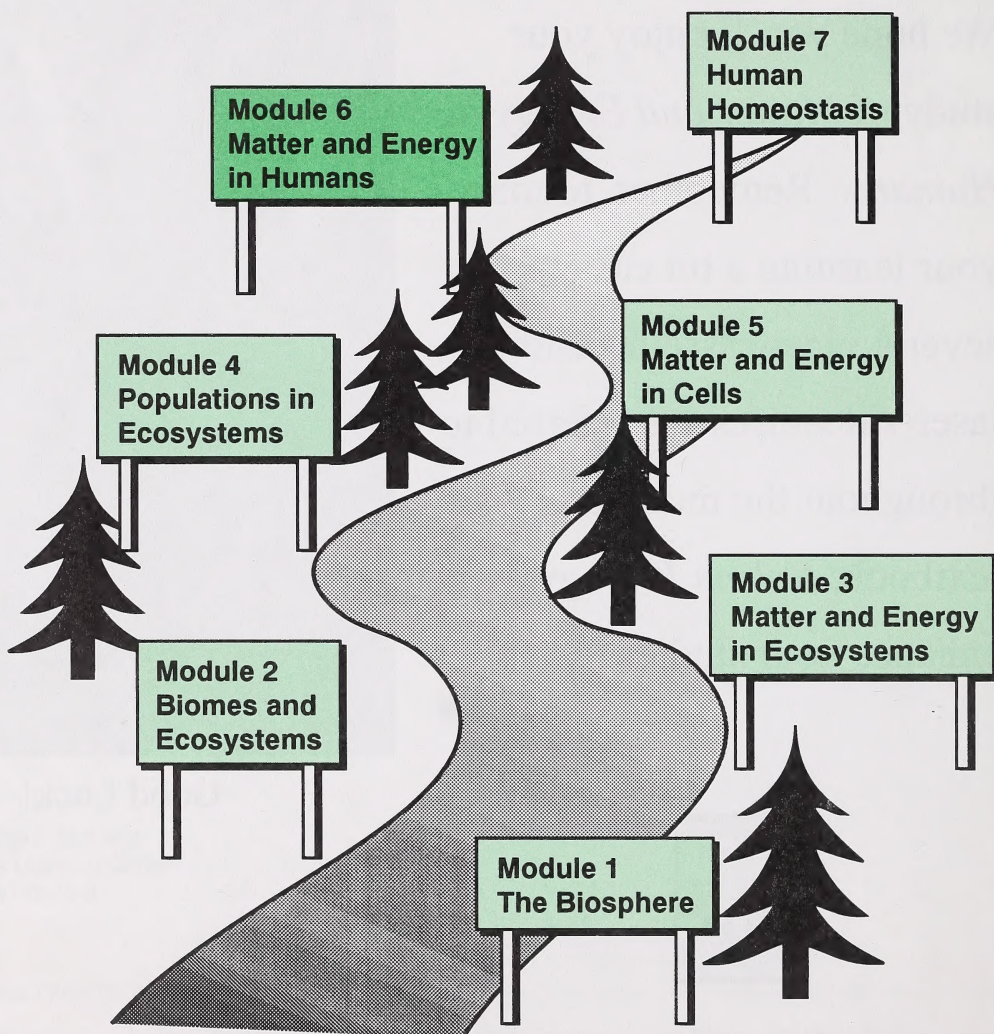
We hope you'll enjoy your study of *Matter and Energy in Humans*. Remember, to make your learning a bit easier, several videocassettes and laser videodiscs are referred to throughout the modules. Your textbook, *Nelson Biology*, will enhance your studies.



Good Luck!

COURSE OVERVIEW

This course contains seven modules. The module you are working in is highlighted in a darker colour.



MODULE

6

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MODULE

6

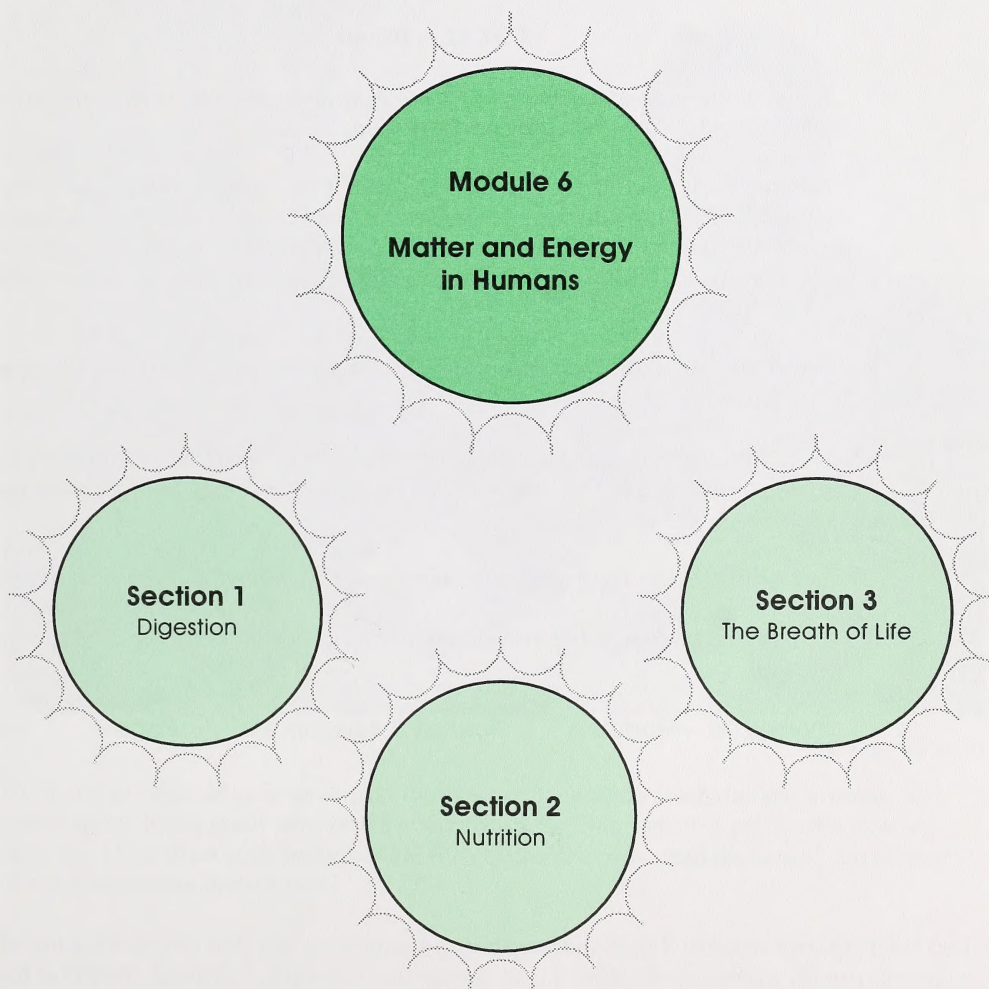
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MODULE OVERVIEW

In Module 5 you studied the movement of matter and energy in living cells. The big processes were photosynthesis and respiration. So what's the connection between you – a living, breathing human – and your environment? How do you and your environment interact? The answer is body systems. Your body has systems that exchange matter and energy with the environment. This keeps you alive. Module 6 explores your digestive and respiratory systems. You'll also study some of the factors of lifestyle and how this affects the health of your living systems.



Evaluation

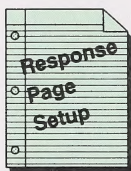
Your mark in this module will be determined by how well you complete the assignments at the end of each section. You must complete all assignments. In this module you are expected to complete three assignments. The mark distribution is as follows:

Section 1 Assignment	40 marks
Section 2 Assignment	25 marks
Section 3 Assignment	<u>35 marks</u>

TOTAL 100 marks

When doing your assignments, work slowly and carefully. If you are having difficulties, go back and review the appropriate section.

Read all parts of your assignment carefully. Plan and do your rough work on your own paper. Revise and edit your responses; then set up your final copy for submission on your own paper. Lined looseleaf is recommended. Make sure your answers are neat and organized, with wide left margins and space for teacher comments after each assignment.



When you see this icon, ideas and details are provided to help you set up and organize your answer in a certain way.

Before submitting your responses, be sure to proofread them carefully to ensure they say what you want, that they are neat and clear, and that they are complete and missing no material.

You will be submitting **only** your **assignment response pages** for evaluation.

It is important to number and clearly identify each page with this information placed at the top.

Biology 20 – Module 6 Section # Assignment Page # Name and ID #

Digestion



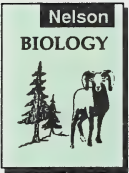
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Think about some of your favourite foods – maybe a pizza fresh out of the oven. It smells good, looks good, and tastes good. But what happens to a pizza after you've eaten it? How does your body handle the cheese, the meat, and the crust? Do all parts of a pizza become part of you?

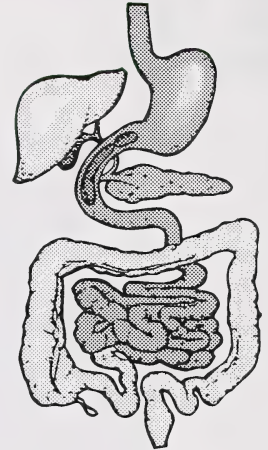
In this section you will study the process of digestion. You will learn how the food you eat is broken down into simpler components as it travels through your digestive system. You will also learn about chemicals called enzymes which play a vital role in digestion and many other important chemical reactions in your body.

ACTIVITY

1 Your Digestive System



What measures between 6.5 m and 9 m in an average-sized adult, but is contained within less than a metre of your body? You're right – it is your digestive tract. Can you believe that you've got that much of it? Take a look at Figure 9.8 on page 233 in your text. This is only part of the system. Now carefully read page 228.



PATHWAYS

If you have access to the video, *Digestive System*, do Part A. If you do not have access to this video, do Part B.

Part A



To introduce you to the complexity of digestion, watch the video *Digestive System*. Pay close attention to the functions of organs. You may even want to make a list. As you watch the video, answer the following twelve questions.

1. Name the parts of the body involved in the initial physical breakdown of food.
2. What is the function of chewing?
3. Why is saliva produced?
4. Explain the process of peristalsis.
5. What would happen to you if your epiglottis didn't close when you were eating?

Food may remain in the stomach for up to two hours while mixing with gastric juices.

HCl –
hydrochloric acid

6. Describe the function of **HCl** in the stomach?

Your pancreas is very important. It secretes a mixture of substances required for digestion of certain foods.

7. Four substances found in pancreatic juice are given in the following table. Give the function of each of these substances.

SECRETION	FUNCTION
Pancreatic amylase	
Lipase	
Trypsin	
Sodium bicarbonate	

Check your answers by turning to the Appendix, Section 1: Activity 1.

Your liver produces bile and your gall bladder stores it until it's needed.

8. State the function of the secretion from the gall bladder.

The longest part of your digestive tract is your intestine. The primary function of the intestine is absorption. Since absorption takes time, the intestine is quite long.

9. How do nutrients reach the cells? (Mention another body system in your answer).
10. List the substances absorbed in the large intestine.

The foods in the picture all contain fibre, which is mostly **cellulose** from plants.

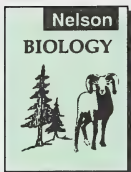
11. Why is cellulose not digested?
12. Describe the importance of fibre in diet.

cellulose – the main part of the cell wall in all plants; humans cannot digest cellulose



PHOTO SEARCH LTD.

Part B



If you do not have access to the video, study pages 229 to 237 in your text and find the answers to the questions from Part A. Trace the path of food along the digestive tract shown in Figure 9.9 on page 234 as you review the questions.

Check your answers by turning to the Appendix, Section 1: Activity 1.

Digestion is only one process in a series of processes necessary to deliver matter and energy to your cells. You've had an introduction to this process and hopefully have an appreciation of organs and systems working together. As a student of biology you now have an opportunity for study beyond just an introduction.

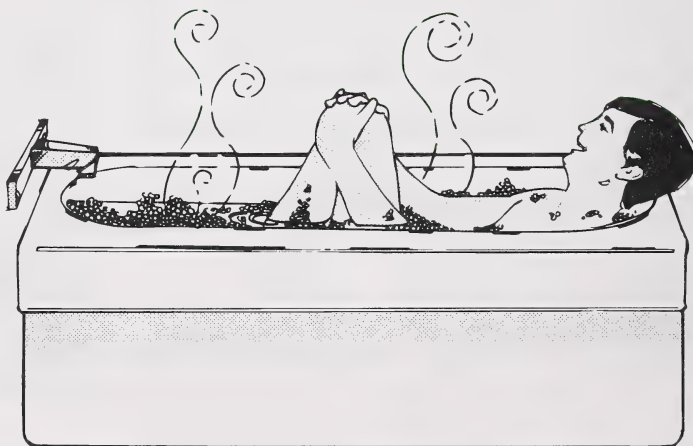


ACTIVITY

2

Enzyme Action

Are you someone who likes hot water in your bathtub? How do you feel about a cold shower? Your feelings are probably completely natural but have a biological basis. Temperature is very important to biochemical reactions. For example, digestion depends on enzymes, and enzymes are highly sensitive to temperature.



As you learned in the last activity, enzymes play a big part in digestion. So how do enzymes really function?

PATHWAYS

If you have access to the video *Harvest of Enzymes*, do Part A. If you do not have access to this video, do Part B.

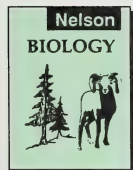
Part A



Watch the video *Harvest of Enzymes* and answer the following questions. Keep in mind that nearly all chemical reactions in the body are controlled by enzymes.

1. The first time enzymes get involved in digestion is right in the mouth. What does the enzyme in saliva do?
2. Explain what enzymes in the body do.
3. Describe the difference between an enzyme and a substrate.
4. How are enzymes specific to substrates?

Part B

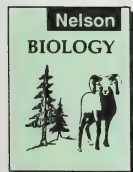


Read pages 179 to 180 in your text, and then answer the questions in Part A. Pay particular attention to the definitions of *catalyst*, *enzyme*, and *substrate*.

Check your answers by turning to the Appendix, Section 1: Activity 2.

By lowering the activation energy of a reaction, enzymes cause chemical reactions to occur at normal body temperature. Enzymes also ensure that all the body's reactions will occur at the same temperature. Therefore, enzymes are important.

Pages 181 to 182 in your text describe factors that affect enzymes.



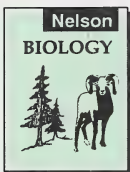
5. Look at Figures 7.10, 7.11, and 7.12 and identify three important factors that affect enzymes.
6. What is meant by optimal temperature?
7. Why do enzymes stop working at temperatures above optimal?

Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☒ E. Synthesizing
- ☐ F. Evaluating

8. Briefly explain how a change in pH will affect an enzyme.
9. Figure 7.12 on page 182 shows an enzyme reaction increasing as the substrate concentration increases. See Line X on the graph.
 - a. Explain why the line levels off.
 - b. What could cause the line to rise again?

Check your answers by turning to the Appendix, Section 1: Activity 2.



Besides temperature, pH, and substrate concentration, enzymes can also be affected by inhibitors. Inhibitors may be natural, such as end products in reactions, or unnatural such as toxins or poisons. Read about feedback inhibition on page 183.

Perform this next investigation to see the effect of temperature on an enzyme.

Investigation: Enzymes and Temperature

Objective

Observe the influence of temperature on enzyme action.

Background Information

denatured – to be made inactive

As proteins, enzymes may be **denatured** by high temperatures. This usually is caused by a change in enzyme shape and may be permanent.

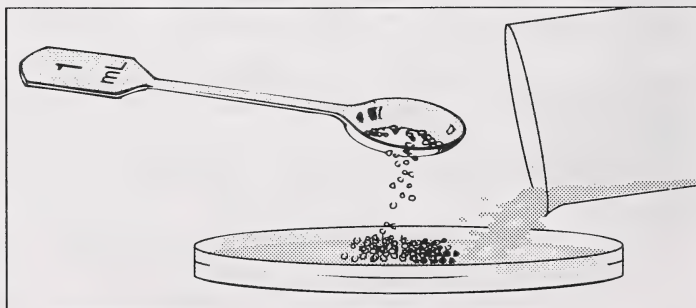
Materials

- package of gelatin
- hot water
- 1 mL measuring spoon
- 5 mL meat tenderizer
- three petri dishes
- refrigerator

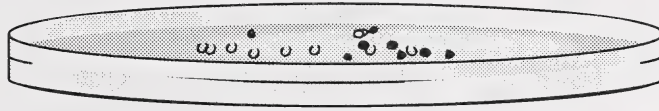
Procedure

Prepare the gelatin in hot water.

Add 1 mL of meat tenderizer to one petri dish. Pour in the hot gelatin to half fill the petri dish.



Pour a second petri dish of gelatin and let it set at room temperature for fifteen minutes. Sprinkle 1 mL of meat tenderizer evenly on the surface of this dish of gelatin. Leave at room temperature and observe any changes in the surface of the gelatin. Continue to assess the texture at five-minute intervals for the next fifteen minutes.



Repeat the procedure, but this time use a dish of gelatin that has been thoroughly chilled in the refrigerator or freezer before adding the meat tenderizer. Observe the initial effect of the tenderizer and watch for any changes as the gelatin warms slowly to room temperature.

Assess the texture of the dish of gelatin in which the meat tenderizer was added to the hot gelatin during the preparation phase.

Observations

10. Record your observations in chart form.

Analysis and Interpretation

11. Gelatin is a simple protein. What happens to the gelatin in the presence of the meat tenderizer?
12. If the hot water denatured the meat tenderizer enzyme, predict the effect this would have on the gelatin.
13. When you are barbecuing, should you add meat tenderizer during the cooking of the meat?

Try this at home. Using two pieces of meat, sprinkle meat tenderizer on one piece about one hour before cooking it. Sprinkle the meat tenderizer on the other piece, while you are cooking it. Look for the difference in texture.



Check your answers by turning to the Appendix, Section 1: Activity 2.

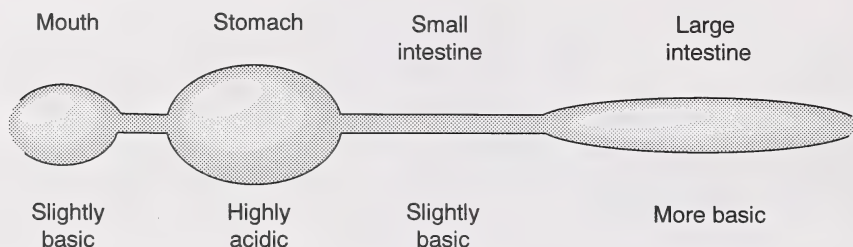
Science Skills

- ☐ A. Initiating
- ☒ B. Collecting
- ☒ C. Organizing
- ☐ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating

Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☒ E. Synthesizing
- ☐ F. Evaluating

The pH of the digestive tract changes substantially as food progresses through it. The slightly basic pH of the mouth becomes highly acidic in the stomach. The initial pH in the small intestine is neutral and changes to a more basic pH (alkaline) in the large intestine.



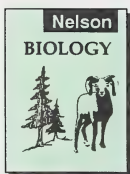
Enzymes along the digestive tract each react to their own optimal condition of pH. The effect of pH on enzymes in the stomach can be studied.

PATHWAYS

If you have access to laboratory facilities, do Part A. If you do not have access to laboratory facilities, do Part B.

Investigation: Enzymes and pH

Part A



To see the effect of pH on enzymes do the Laboratory on page 237 in your text.

Note the use of 0.1 mol NaOH and 0.1 mol HCl and exercise appropriate caution.

14. Answer the Laboratory Application Questions on page 237 in your text.

Caution

Enzymes aren't always studied in test tubes. Read the account of Beaumont and St. Martin on page 238 in your text. This is an example of early medical research that would be quite unlikely today.

Science Skills

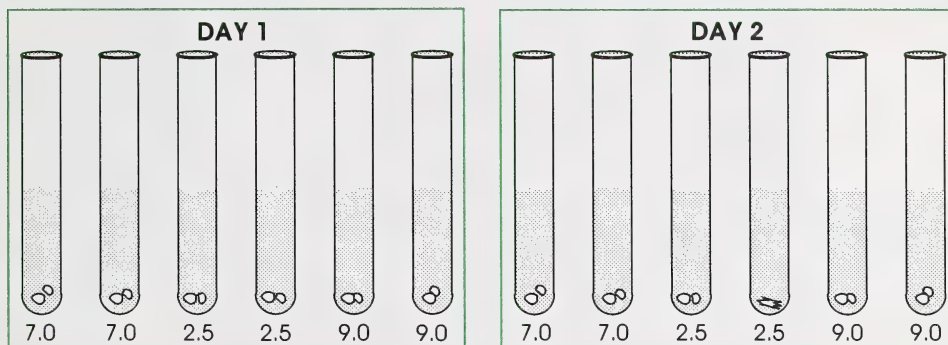
- ☐ A. Initiating
- ☒ B. Collecting
- ☒ C. Organizing
- ☒ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating

Veterinary research sometimes involves the use of cattle with permanent "windows" into their stomachs. This research may make important contributions to what is known about digestion and absorption.

Check your answers by turning to the Appendix, Section 1: Activity 2.

Part B

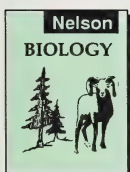
Compare the results in these six test tubes for the first and second day.



TEST TUBE	HARD-BOILED EGG	DISTILLED WATER	HCl	PEPSIN	NaOH
1	✓	✓			
2	✓	✓		✓	
3	✓		✓		
4	✓		✓	✓	
5	✓				✓
6	✓			✓	✓

Use your observations to answer the Laboratory Application Questions on page 237 in your text. Review the discussion on the Stomach on page 230 and 231 if you are unclear of the relationship between HCl and pepsin.

15. If you were to take several antacids pills, what would be the effects on protein digestion in your stomach?



Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☒ E. Synthesizing
- ☐ F. Evaluating

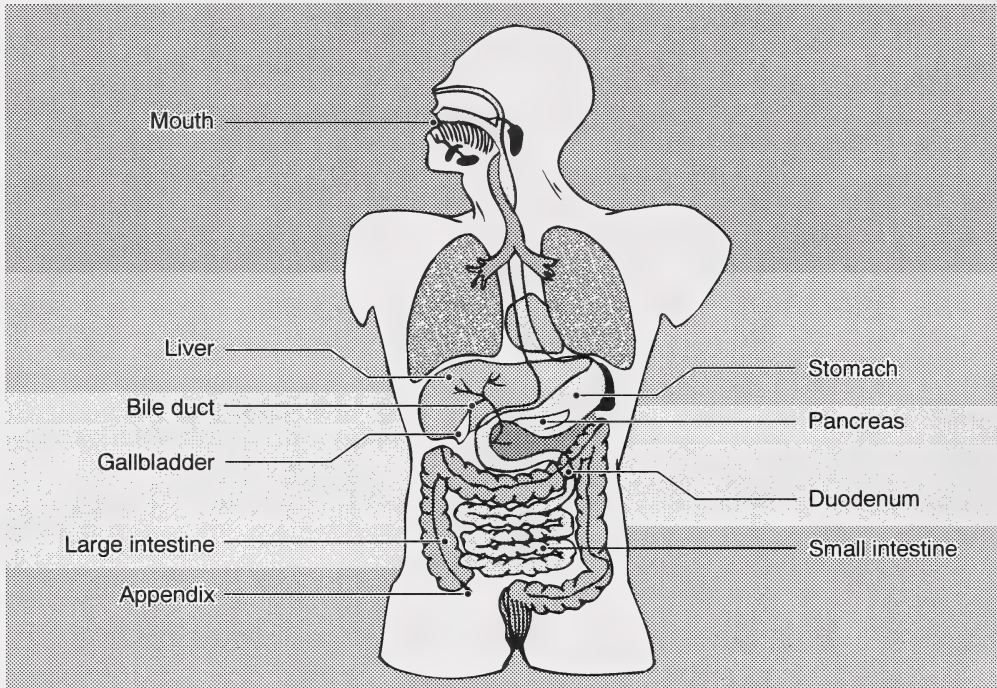
Check your answers by turning to the Appendix, Section 1: Activity 2.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

1. Match each statement with the appropriately labelled part of the digestive system. You may use the terms more than once.

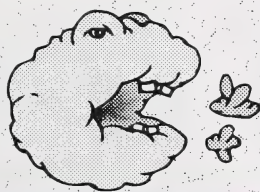


- a. This is the area where physical digestion begins.
- b. The majority of digestion occurs in this area.
- c. This area absorbs large amounts of water.
- d. This area is the site for the final stages of carbohydrate digestion.
- e. This area produces bile salts.
- f. This area has the lowest pH.
- g. This area contains tiny folds called villi.
- h. This area secretes an enzyme which curdles milk.
- i. This area produces a number of secretions required by the small intestine.
- j. This area is the site of the secretion of pepsin.

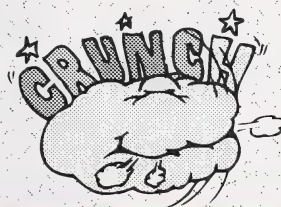
- k. The absorption of essential nutrients occurs primarily in this area.
 - l. This area is the site for the emulsion of fats.
 - m. This area serves no particular function to aid in digestion and is sometimes removed.
 - n. This area contains bacteria which make vitamins.
 - o. This area stores bile.
2. Read the following description of enzyme action.

Enzymes are proteins which take apart or put together other molecules. Each enzyme is responsible for just one specific reaction.

- 1 A typical enzyme lies in wait for the right molecules to come around.



- 2 The enzyme binds to the small molecules ...



- 3 ... and combines them ...



- 4 ... into a new molecule, which is released.



- 5 The enzyme itself remains unchanged in the process.



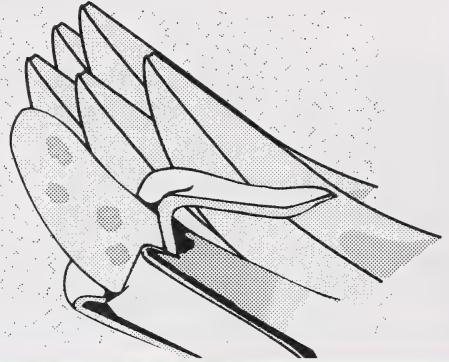
- 6 In a similar way, digestive enzymes break down large molecules. Several kinds, for example, break sugars off polysaccharides !



7

These proteins are important because virtually every one of life's chemical reactions is driven by some enzyme.

When nutrients come up through the roots of a banana tree, the tree's enzymes convert them into bananas ...



8

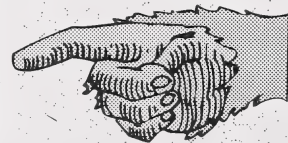


Then when the chimpanzee eats the banana, the chimpanzee's enzymes digest the banana and convert the nutrients into chimpanzee proteins .

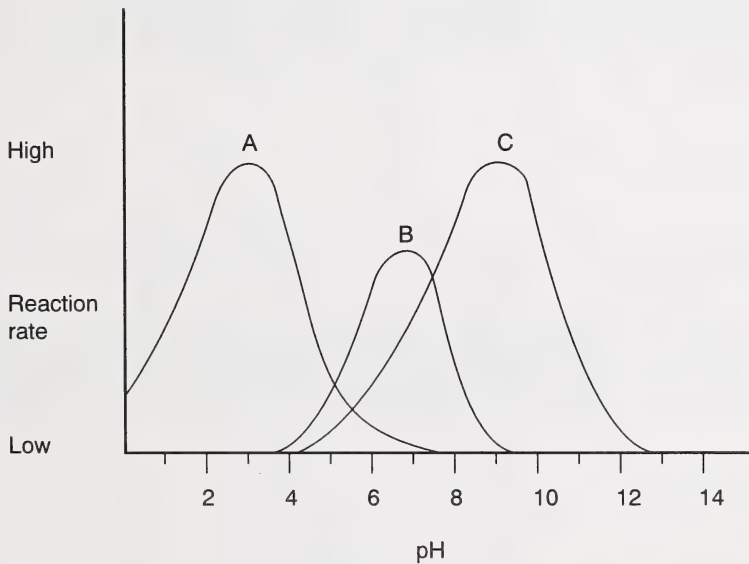
9

In other words:

**An organism
is built by
its enzymes.**



- a. Describe the two opposite roles enzymes can play in the body.
- b. Enzymes along the digestive tract are each active at a particular pH. The pH of the digestive tract changes from place to place. This affects enzyme action. Match the enzymes on this graph with the following digestive organs:
- small intestine
 - large intestine
 - stomach



Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☒ C. Organizing
- ☒ D. Analysing
- ☒ E. Synthesizing
- ☐ F. Evaluating

3. The following chart can be very useful for future reference. Complete the chart using your text as a reference.

ORGAN	SECRETIONS	COMPONENTS	ACTION
Mouth	saliva	mucus	lubricates
		amylase	
Stomach			activates conversion of pepsinogen to pepsin
		rennin	
			breaks down proteins into polypeptides

ORGAN	SECRETIONS	COMPONENTS	ACTION
Liver		bile salts	
Pancreas			neutralizes acids
			breaks down starch
		lipase	
		trypsin	
Small intestine			breaks down peptides into amino acids
		maltase	
			breaks down lactose
		sucrase	
			activates trypsinogen
		peptidases	

Check your answers by turning to the Appendix, Section 1: Extra Help.

Enrichment

Do one or more of the following; question 3 is recommended.

- Colitis and ileitis are serious disorders of the intestinal tract. Research some of the causes of these conditions and find out what dietary habits are implicated.
- Liver cancer is one of the most serious forms of cancer. What dietary habits are implicated with liver disease? Two excellent sources of information are the Canadian Cancer Society and the Canadian Liver Foundation. Contact these organizations to obtain current information and compile a report on liver diseases.
- Write to the Canadian Cancer Society and ask for information on cancer and diet. Ask for pamphlet number 211419, *Facts on Cancer and Diet* and any other information available.

Canadian Cancer Society
 Alberta-Northwest Territories Division
 200 – 2424 – 4th Street S.W.
 Calgary, Alberta
 T2S 2T4



4. Contact the Alberta Heart and Stroke Foundation of Alberta and arrange to view the video *Healthy Choices, Healthy Hearts*. Use the video as a basis for a class presentation on diet and heart health. The video is also available through ACCESS Network.

Heart and Stroke Foundation of Alberta
10985 – 124 Street
Edmonton, Alberta
T5M 0H9

Check your answers by turning to the Appendix, Section 1: Enrichment.

Conclusion

The food you eat brings matter and energy from the environment to your body. Your digestive system reduces the food to useful components using enzymes, digestive secretions, and special organs. The useful components of your food must be delivered to your cells. Components that are not useful must be disposed. Continue with the next section to study these components.

40

Section 1 Assignment: Digestion

Review the Evaluation information found in the introductory pages of this module.

It is important to number and clearly identify each page with the following information at the top:

Biology 20 – Module 6 Section 1 Assignment Page # Name and ID#

Be sure to write legibly. Leave a wide left margin and number all of your pages.

1. Match the following digestive organs to the functions listed. You can use the names of the organs more than once. (10 marks)

- | | | |
|-------------|---------------|-------------------|
| • mouth | • pancreas | • small intestine |
| • esophagus | • liver | • large intestine |
| • stomach | • gallbladder | • epiglottis |

a. digests fats

b. secretes HCl

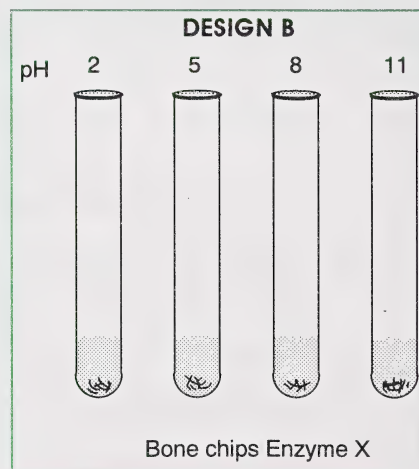
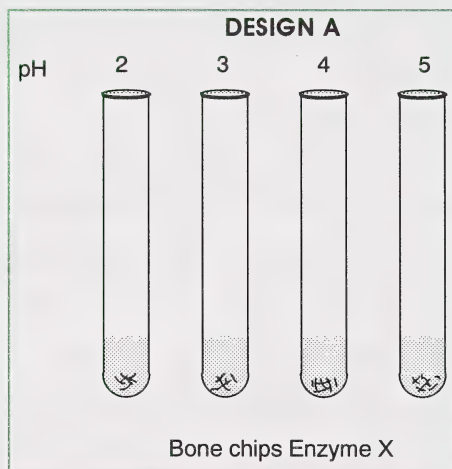
- c. secretes salivary amylase
- d. holds bile until required
- e. stores glycogen
- f. secretes sodium bicarbonate
- g. absorbs water and produces vitamins
- h. digests proteins
- i. begins starch digestion
- j. benefits from dietary fibre

Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☒ E. Synthesizing
- ☒ F. Evaluating

2. Enzyme X may digest bones but the best pH for this enzyme is unknown.

Two experimental designs to determine the best pH are shown. Choose which is the best design and explain why. (5 marks)



Reproduce the science skills assessment box after your response to this question. Remember to indicate your evaluation of your skill level for each identified science skill. Be sure to include the spaces for teacher assessment.

Self: A.	☐	B.	☐	C.	☐	D.	☐	E.	☐	F.	☐
Teacher: A.	☐	B.	☐	C.	☐	D.	☐	E.	☐	F.	☐

Science Skills

- ☐ A. Initiating
☐ B. Collecting
☐ C. Organizing
☒ D. Analysing
☒ E. Synthesizing
☐ F. Evaluating

- Protein digestion is very active in the stomach. Explain why the stomach doesn't digest itself. (5 marks)
- Cells in the wall of the stomach produce pepsinogen, which plays a role in protein digestion. Why don't these cells digest themselves? (5 marks)
- Many detergents have a relatively basic pH (8.0 – 9.0) which increases their effectiveness in washing dishes. Describe a digestive secretion that behaves similarly to a detergent. (5 marks)
- If a plain soda cracker or plain (no salt) potato chip is chewed for a while before being swallowed, it will gradually begin to taste sweeter. Explain how enzyme action causes this effect. (5 marks)
- The following experiment was performed in a laboratory. (5 marks)

TEST TUBE CONTENTS	TEST TUBES					
	NOT BOILED			BOILED		
	1	2	3	4	5	6
Pepsinogen (15 mL)	✓	✓	✓	✓	✓	✓
Egg white (3 mL)	✓	✓	✓	✓	✓	✓
H ₂ O (distilled)	✓	✓	✓	✓	✓	✓
HCl (dilute acid)		✓			✓	
NaOH (dilute base)			✓			✓
The contents of test tubes 4, 5, and 6 were boiled for ten minutes. All test tubes were then incubated at 37°C for twenty-four hours. A test for products of protein digestion was then performed on the contents of each of the six test tubes.						

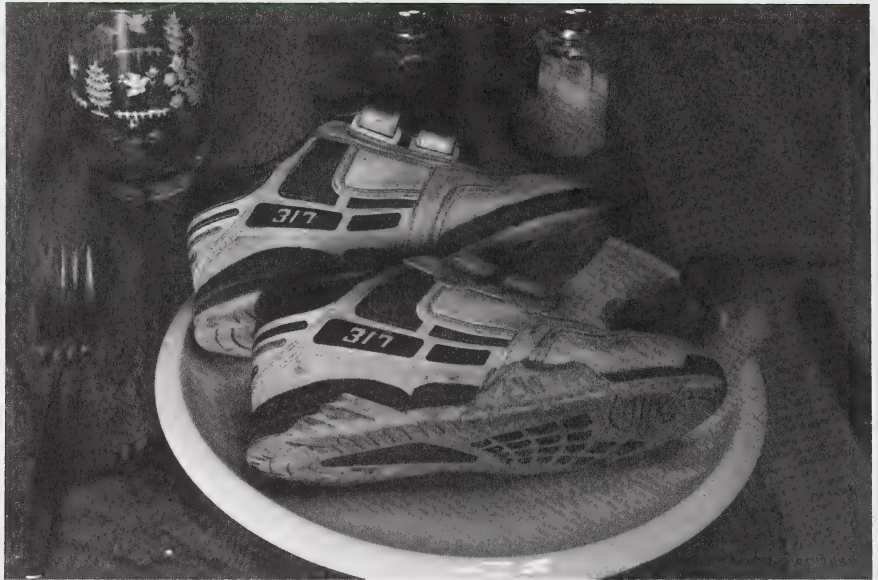
Based on the results given, answer the following questions:

- Which test tube(s) would show no protein digestion and why?
- Which would show the greatest digestion?
- Discuss the effect of sodium hydroxide (NaOH) on the action of pepsinogen.

SECTION

2

Nutrition



Would you consider what is shown in the photo to be a tasty meal? Probably not. However, you can physically eat almost anything – even an old pair of shoes. Most likely you would choose something different to eat, like a steak. Naturally, eating a pair of old running shoes might not be very nutritious. It could also have a drastic effect on your digestive system.

So what's the difference? Certainly taste and nutrition are obvious differences. But what's actually in a steak that makes it nutritious? This question leads to the actual components of food.

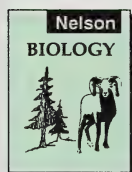
In this section you'll study the main components or essential nutrients found in all foods. You'll learn how to test for certain nutrients and study the difference between a nutrient and an additive. You will come to recognize good nutrition and appreciate that if you are kind to your digestive system, your digestive system will be kind to you.

ACTIVITY

1 Carbohydrates

organic –
contains carbon
atoms

inorganic – does
not contain
carbon atoms



The variety of foods in a large food store is certainly overwhelming. But basically all food contains varying amounts of three groups of **organic** molecules. These are carbohydrates, lipids, and proteins. To a degree, foods may also contain **inorganic** molecules, such as nitrates and phosphates, and minerals or elements, such as calcium, iron, magnesium, and potassium. All of these components are useful to the body and generally provide either building materials or energy. Check page 159 in your text for a definition of organic molecules; then read pages 160 to 162 for an introduction to carbohydrates. Now answer the following questions.

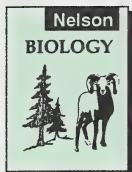


PHOTO SEARCH LTD.

1. What life forms can manufacture carbohydrates from carbon dioxide and water?
2. What is another common name for a basic carbohydrate?
3. How are carbohydrates classified?
4. In what form do plants mostly store carbohydrates?
5. In what form do animals most commonly store carbohydrates? Incidentally, in humans this substance is stored in the liver.

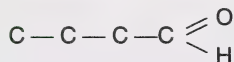
Remember that carbohydrates are your main source of energy in nutrients. It's easy to test foods for the presence of carbohydrates.

Investigation: Identification of Carbohydrates

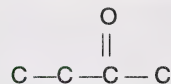


Follow the Laboratory on page 163 in your text. Note the use of heat and exercise appropriate caution. Read Background Information on page 163. You'll notice the term *reducing sugars* in the text. A reducing sugar is one that contains an **aldehyde** or **ketone** group. You can see these in Figure 6.10 on page 161 in your text.

This is an aldehyde:



This is a ketone:



Notice the difference in the location of the oxygen atom. In aldehydes it's attached to the end carbon; in ketones it's not. That's the simple difference. This amount of detail is beyond what you need to know at this time. It is important to remember that **Benedict's solution** is used to detect the presence of reducing sugars as this lab will demonstrate.

6. Describe the reactive substance in Benedict's solution and include how it reacts to reducing sugars.
7. What could you conclude if Benedict's solution was added to a substance and heated and the colour stayed blue?

Procedure

Set up and perform the Laboratory on page 163.

8. Answer questions 2. (a), 3. (b), 4. (c), and 5. (d) from pages 163 and 164 of your text.

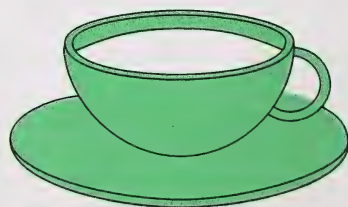
Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☒ E. Synthesizing
- ☐ F. Evaluating

Check your answers by turning to the Appendix, Section 2: Activity 1.

Instead of testing unknowns as described in the Laboratory on page 163, try testing some common liquids such as tea, coffee, clear soup, or soda pop for sugars and starch.

At the end of this investigation, thoroughly wash all your laboratory glassware. This lab activity has given you an opportunity to positively identify the presence of a carbohydrate. Now you are ready to test for proteins and lipids.



ACTIVITY

2 Lipids and Proteins

Investigation: Identification of Lipids and Proteins

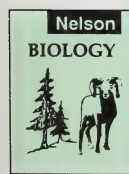
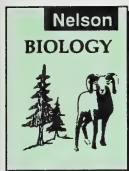
In preparation for this investigation, read the sections entitled Lipids on pages 164 and 165 and Proteins on page 168 and 169 in your text.

1. What is an important function of lipids?
2. In animals, glycogen is the primary form of energy storage because it is easily converted to glucose. How do lipids play a role in energy storage in relation to glycogen?
3. Describe three functions of lipids besides energy storage.
4. Name three common forms of lipids.
5. What two common forms of triglycerides are found in animals and plants?
6. Similar to carbohydrates, proteins contain carbon, hydrogen, and oxygen. What two other elements are found in proteins?
7. What is the basic structural component of proteins?
8. Explain how eating beef protein can contribute to the development of human protein?
9.
 - a. Of the twenty known amino acids, how many can the human body make for itself?
 - b. Where must the other amino acids come from and what are they called?
10. What is the name of the chemical bond that joins amino acids together to form proteins?

Check your answers by turning to the Appendix, Section 2: Activity 2.

Now turn to the Laboratory on page 171 in your text and read Background Information.

11.
 - a. What test identifies the presence of proteins in food?
 - b. With what part of a protein molecule does biuret reagent react?
12. What two tests can be used to identify lipids?



13. a. Describe a positive Sudan IV test.
 b. Describe a positive translucence test.
 c. Describe a positive biuret test for protein.
14. Predict the result of an enzyme that is tested with Sudan IV and with biuret reagent. Explain your prediction.

Science Skills

- ☐ A. Initiating
☐ B. Collecting
☐ C. Organizing
☐ D. Analysing
☒ E. Synthesizing
☐ F. Evaluating

You will have to supply the following materials:

Materials

- water
- vegetable oil
- unglazed brown paper (Newsprint is okay.)
- glucose solution (1 mL sugar in 100 mL of water)
- liquid soap (Use a little hand soap in water.)
- egg albumin (fresh egg white)
- liquid detergent (dish detergent)
- solutions X, Y, Z (Use tea, coffee, soda pop, milk, liquid gelatin, soup broth, or any other common foods.)

Caution

Proceed with the investigation.

Be careful with the biuret and Sudan IV. Do not get either of the solutions on your skin.

15. Answer questions 2. (a), 4. (b), 5. (c), and 6. (d) from page 171 of your text.

Nelson**BIOLOGY****Science Skills**

- ☐ A. Initiating
☒ B. Collecting
☐ C. Organizing
☐ D. Analysing
☐ E. Synthesizing
☐ F. Evaluating

SOLUTION	SUDAN IV	TRANSLUCENCE	BIURET
Glucose			
Gelatin			
Soap			
Egg			
Detergent			
X			
Y			
Z			

Science Skills

- ☐ A. Initiating
☐ B. Collecting
☐ C. Organizing
☐ D. Analysing
☒ E. Synthesizing
☐ F. Evaluating

16. Just to make sure that you understand the tests used to positively identify carbohydrates, lipids, and proteins, complete a summary chart like the following:

SUBSTANCE	TEST SOLUTION	INITIAL COLOUR	POSITIVE TEST COLOUR
Reducing sugar			
Starch			
Protein			
Lipid			

17. What if you were planning a 10-km bike race? Which food type would you select for the most energy – proteins, carbohydrates, or lipids (fats)?



Check your answers by turning to the Appendix, Section 2: Activity 2.

ACTIVITY

3

Calorimetry

How do people determine the amount of energy in food? The answer is with a device called a bomb calorimeter. You might remember this device from Module 1. The substance to be analysed is placed in the calorimeter and ignited. As the substance burns, heat is released (energy). The heat warms the surrounding water and the increase in temperature is measured. This value can be related to the amount of energy in the substance. Check the description of calorimetry in your text on page 57.

- Predict the relative amounts of energy in fats, proteins, and carbohydrates if equal masses of each were tested in a calorimeter.
- Which would you predict would produce the most energy, 5 g of fresh apple or 5 g of dehydrated apple? Explain your answer.

Check your answers by turning to the Appendix, Section 2: Activity 3.

Nelson
BIOLOGY



Science Skills

- ☐ A. Initiating
☐ B. Collecting
☐ C. Organizing
☐ D. Analysing
☒ E. Synthesizing
☐ F. Evaluating

ACTIVITY

4

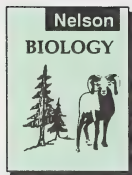
Vital Vitamins and Mighty Minerals



WESTFILE INC.

Has someone ever told you to eat some food because it contained essential vitamins and minerals? Do you know why you need vitamins and minerals?

Vitamins are organic molecules required in small amounts by your body. They are important for normal metabolic functions like growth and energy production.



Take a moment and read the Biology Clip on page 391 in your text.

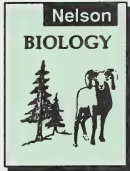
You can see that vitamin A is important in everyday life. But the body cannot manufacture vitamin A; it must be acquired through the diet. Lack of vitamin A, or any other vitamin for that matter, can result in a nutritional deficiency. Many diseases are caused by nutritional deficiencies. In many cases the deficiency is not a lack of proteins, fats, or carbohydrates but rather a lack of vitamins or minerals.

Study the following chart showing the vitamins you need.

VITAMIN	FUNCTION	DEFICIENCY SYMPTOMS	DAILY REQUIREMENTS (16-18 YEARS OF AGE)	FOOD SOURCE
A	- maintains healthy skin, hair, eyes, etc. - improves resistance to infections - helps break down fats	- rough, dry skin - low resistance to infections - night blindness	- girls – 4000 IU - boys – 5000 IU	- whole milk - liver - butter - carrots - eggs - green and yellow vegetables
D	needed for calcium and phosphorus absorption to produce good bones and teeth	- rickets - softening of bones in adults - poor teeth	400 IU	- fish liver oils - sardines, salmon, liver - some made by the skin in sunlight
E	- helps in the formation of red blood cells, muscle, and other tissues - prevents abnormal breakdown of fat	- circulation problems - loss of sexual and body vigor - muscular and heart problems		- vegetable oils - whole grain cereals
K	aids in blood clotting	rare, generalized bleeding		green vegetables
Thiamine (B₁)	- needed for oxidation of carbohydrates - ensures proper use of sugars	- loss of energy - depression - poor appetite - skin problems	- girls – 1.1 mg - boys – 1.5 mg	- whole grain cereals - dry yeast - pork - fish - lean meat
Riboflavin (B₂)	- needed for energy metabolism in cells - helps synthesize fats	- tissue damage - eye strain - fatigue - itching - sensitivity to light	- girls – 1.4 mg - boys – 1.8 mg	- liver - milk - cheese - green leafy vegetables - beans
Niacin (B₃)	involved in energy reactions in cells	- lack of concentration - headaches - insomnia - backache - poor memory	- girls – 14 mg - boys – 20 mg	- meat - poultry - fish - whole wheat and enriched grains
Vitamin B₁₂	- builds genetic molecules - essential for proper functioning of the nervous system	- anemia - bowel disorders - poor appetite - poor growth		- liver - kidney - fish
C	helps to maintain normal development of bones, teeth, gums, and cartilage	- scurvy - bleeding gums - easy bruising - low resistance to infections	45 mg	- citrus fruits - green vegetables - potatoes

Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating



- How would your health be affected if your diet lacked sufficient thiamine, riboflavin, and niacin?
- Name three foods that are packed with more than one vitamin.

Vitamins are extremely important in your diet as you can see from the table.

Minerals are metallic ions that function in a similar way to vitamins. They also enable important chemical reactions to take place. Here is a chart of essential minerals:

- Read about anemia on page 273 in your text. What dietary deficiency may cause this condition?

Use the following table for the next questions.

	FUNCTION	DEFICIENCIES	SOURCES
Calcium	- forms bones and teeth - aids blood clotting and nerve impulse connection	poor calcification of teeth and bones	- common in many foods - milk - cheese - cereals - beans - hard water
Phosphorus	- also required for teeth and bones - involved in some cell reactions	poor development in teeth and bones	- meats - fish - dairy products - grains - common in many foods
Iron	- is needed for hemoglobin - helps cells obtain energy from foods	- anemia - lack of energy - especially needed in young children, girls, and women	- liver - heart - meats - green leaf vegetables - whole wheat bread - cereals - nuts
Iodine	forms hormones in thyroid gland	- goitre - swollen thyroid gland	- seafood - iodized table salt
Sodium	regulates water between cells and blood	dehydration	- table salt - bread - canned meats - vegetables
Potassium	is needed for synthesis of proteins in cells	weakness in muscles	- meats - cereals - milk - fruits - green vegetables
Fluoride	strengthens teeth especially during development	more rapid tooth decay	drinking water by natural or artificial addition

Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating

4. Osteoporosis is a condition which leads to brittle bones. Which mineral does a person need when they have this problem?
5. List three foods that would be excellent sources of this mineral.

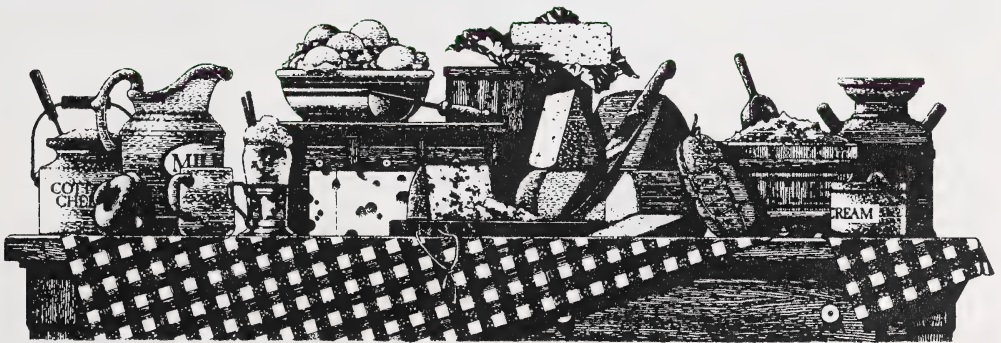
Check your answers by turning to the Appendix, Section 2: Activity 4.

Vitamins and minerals are so essential to good health that without them many people would suffer a great deal of illness. Having a complete nutritional diet keeps your body in balance.



ACTIVITY

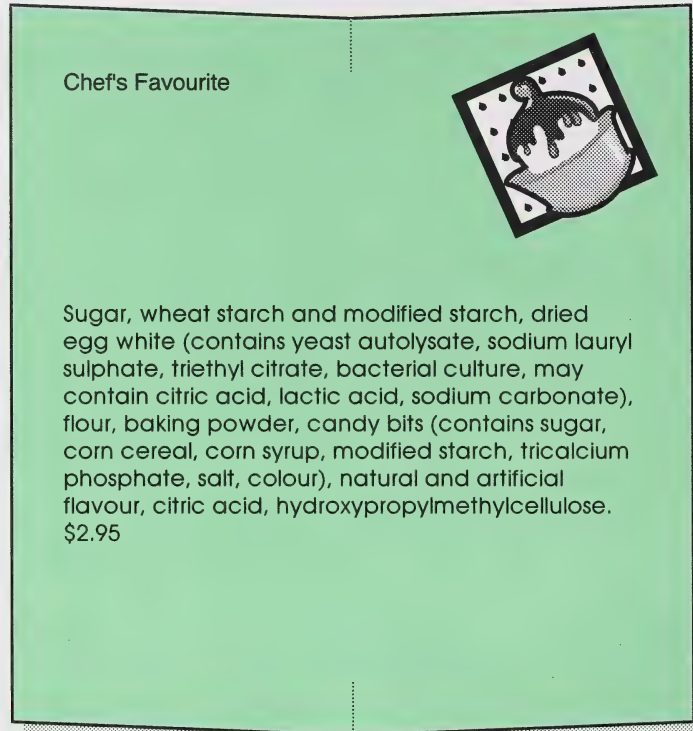
5 Processed Food



If any food you purchase is not fresh, chances are that the bottle, can, or box contains more than just the basic food. Besides carbohydrates, lipids, proteins, vitamins, and minerals, what else could be in food? Read the following:

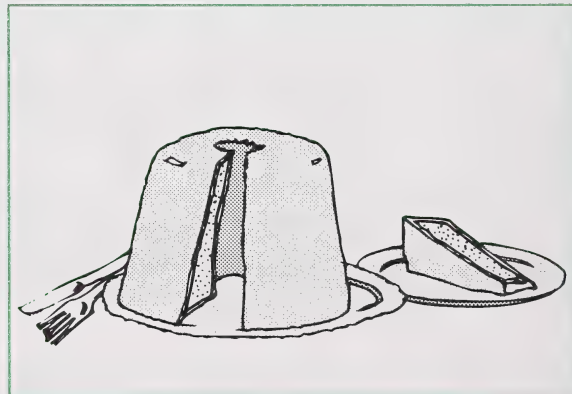
What's Really on the Menu?

Suppose you were to walk into a restaurant and start reading the menu. One of the items looks like this:



Upon further inquiry you are informed that the described item is really your favourite dessert – angel food cake.

How many ingredients can you actually identify? Sugar, flour, and baking powder are all essential parts of the cake, but most of the other ingredients are additives, that is, nonessential nutrients.



Food additives have many effects on foods and can be classified in the following way:

TYPE OF ADDITIVE	PURPOSE	EXAMPLE
natural flavour additive	enhance flavour	sugar or salt
synthetic flavour additive	enhance flavour	wintergreen
antimicrobial compound	prevent food from getting mouldy or rancid	calcium sorbate
antioxidants	prevent food from getting mouldy or rancid	BHA (butylated hydroxyanisole; BHT (butylated hydroxytoluene)
emulsifiers	keep food evenly mixed and uniformly textured	gelatin, acacia gum, mono- and diglycerides
bleaching agents	whiten food	chlorine, chlorine dioxide, potassium bromate
antifoaming agents	clarify food	dimethylpolysiloxane
colouring agents	enhance colour	not usually specified
pH-adjusting agents	prevent metal ions from altering colour and flavour	acids or bases

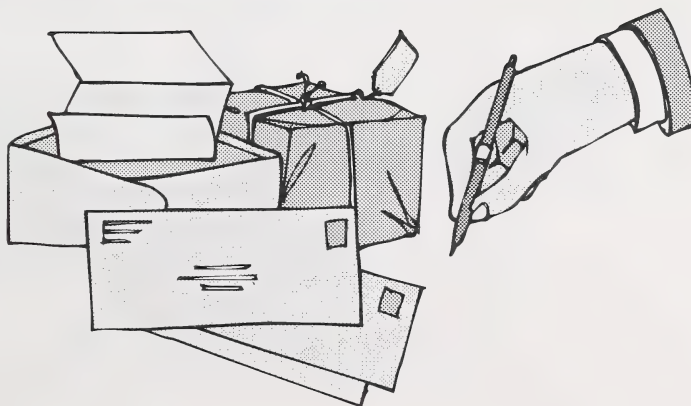
1. Why do you suppose that there are so many additives?

Can additives endanger your health? This is a difficult question. Because there are strict laws regulating their use, additives are generally considered safe. However, there are growing concerns about their usage. People with allergies need to be especially careful.

Check your answers by turning to the Appendix, Section 2: Activity 5.

Science Skills

2. Identify an additive in your favourite box of cereal. Compose a letter requesting information about why the additive is in the product. Make a copy of your letter and send it to the manufacturer.



You may not be able to control what goes into food, but you can definitely become better consumers by reading labels and choosing products with fewer additives.

So how do you feel about angel food cake now?

In the past, people sometimes dried or smoked some of their food to preserve it. Now canning and freezing are more popular ways of preserving food. Recently exposing food to radiation – **irradiation** – has been used to preserve some foods.

irradiation – a process which destroys microorganisms by exposing substances to cobalt-60, a radioactive isotope

The international food irradiation symbol has been established to designate food products which have been irradiated.



Examine the following table.

	IRRADIATION	FREEZING
Equipment required	irradiator	freezer and containers
Effectiveness	very effective	very effective when done right
Effect on nutrients	no effects	slightly less nutrients
Possible health hazards	none apparent	none apparent

Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☐ E. Synthesizing
- ☒ F. Evaluating

3. Considering the information given, which method of food preservation would you recommend and why?

Check your answers by turning to the Appendix, Section 2: Activity 5.

Just as X-rays used in airport security don't make your suitcase radioactive, neither does irradiation make your food radioactive. Consumers who are uninformed generally have great fears about irradiated food.

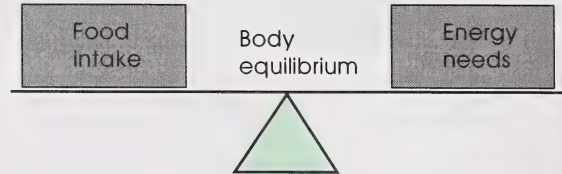
So far in Canada, irradiation of foods is limited to some spices, wheat, flour, and seed potatoes. Use of this technology is increasing along with research.

Science Skills

- ☐ A. Initiating
- ☒ B. Collecting
- ☐ C. Organizing
- ☐ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating

Do you realize that the choices you make will influence your overall susceptibility to disease and life-expectancy? List the foods that you have selected to eat today.

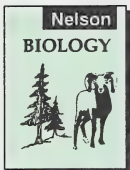
The food you eat will be processed by your body. Consider this ideal situation:



1. If the food intake exceeds the energy output, what will happen to you?

Obesity is a serious problem for many people. Excess weight puts strain on various body systems.

2. Suggest some reasons why more people have weight problems today than when your grandparents were your age.



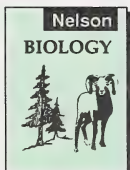
Read the passage Fat in the Arteries: Atherosclerosis on page 248 in your text.

3. Predict what can happen to your circulatory system if you are overweight.

One of the biggest culprits in your diet is fat. Find out why fat is such a big concern by reading page 165 in your text; then answer the following questions.

4. What is the maximum percentage of energy intake in the form of fat allowable in a healthy diet?
5. List three diseases linked to high-fat diets.

High-fat diets are believed to lead to a large number of health problems. One implication of dietary fat is an increase in cholesterol in the blood.



Read page 166 in your text to find out more about The Cholesterol Controversy.

6. Which type of cholesterol is beneficial?

Check your answers by turning to the Appendix, Section 2: Activity 6.

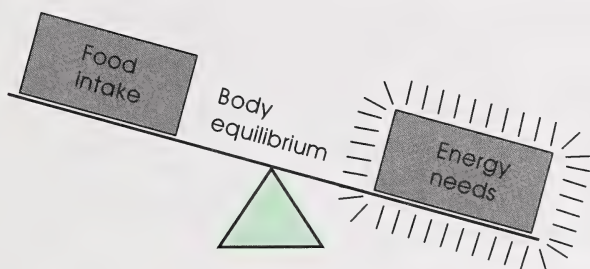
Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☒ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating

Being overweight and eating high-fat foods are two big concerns to society. Often, people spend a great deal of time eating and then spend more time dieting. Sometimes people are attracted to fad diets. Analyse the information entitled Social Issue: Fad Diets on page 241 in your text.

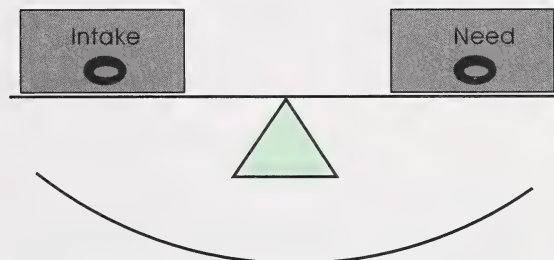
7. List three major concerns with some fad diets.

anorexia nervosa – an abnormal psychological state whereby a person loses all desire for food, and as a result, severe weight loss occurs



Some people develop an inability to stop dieting and suffer from a serious disorder called **anorexia nervosa**. They lose so much weight that it severely affects their normal body functions.

Keeping your body in balance requires not only eating the right foods but maintaining your weight. You are personally responsible for your own good health.



Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

When you think of food, you probably think of some of your favourite things like french fries and ice cream. Although you can see what you are eating, you really can't see the molecules. These molecules are carbohydrates, lipids, and proteins, and they are quite complex.

Besides the three major groups of organic molecules, your food contains vitamins, minerals, water, and sometimes additives. Food is often processed to prevent it from spoiling. One new method of food preservation is irradiation.

1. Decide to which group (carbohydrate, lipid, or protein) each of the following belongs. Then name the chemical test that would be used for positive identification.

FOOD	CHEMICAL GROUP	CHEMICAL TEST
Margarine		
Fish		
Sugar		
Gelatin		
Peanut butter		
Apple		

For questions 2 to 5, select the best choice.

2. Amino acids are building blocks of
 - A. carbohydrates
 - B. lipids
 - C. proteins
 - D. fats
3. Which of the following is not a carbohydrate?
 - A. starch
 - B. cellulose
 - C. glycogen
 - D. corn oil
4. An increase of dietary fat increases a person's risk for all of the following except
 - A. anorexia nervosa
 - B. cancer
 - C. heart disease
 - D. blocked arteries
5. The least common form of food preservation is
 - A. canning
 - B. irradiation
 - C. freezing
 - D. drying
6. Construct a chart using these headings:

ESSENTIAL NUTRIENT	VITAMIN	MINERAL	ADDITIVE
--------------------	---------	---------	----------

Classify the following terms in the chart: calcium, BHA, gelatin, niacin, carbohydrate, lipid, thiamine, glucose, vitamin C, wintergreen, iron, riboflavin, magnesium, artificial colour, iodine, protein.

Check your answers by turning to the Appendix, Section 2: Extra Help.

Enrichment

Do one or more of the following; question 2 is highly recommended.

1. Record all the things that you eat and drink in one day. Categorize the items into essential nutrients and nonessential nutrients. Analyse your diet to determine whether it is balanced and meeting your body's needs.

2. Food irradiation is a physical means of food treatment comparable to pasteurization, canning, or freezing. The process involves exposing food to one of three types of ionizing energy: gamma rays, electrons, or X-rays. It requires a special processing room or chamber and usually involves the radioisotope cobalt-60. It works by disrupting the organic processes that lead to food decay. Bacteria, yeasts, and moulds are broken down, and insects and their eggs or larvae are killed or sterilized. One way to obtain greater consumer acceptance of irradiation is to become informed. For more information on this Canadian technology write to the following address:

Nordion International Inc.,
Market Development New Applications
447 March Road
P.O. Box 13500
Kanata, Ontario, Canada
K2K 1X8

Check your answers by turning to the Appendix, Section 2: Enrichment.

Conclusion

In this section you have learned that the food you eat is made of complex organic molecules which provide essential nutrients required by your body. You have also learned that there are additional substances like vitamins, minerals, and additives. Foods are also processed in various ways.

"You are what you eat" is a slogan which is very true. The food you eat affects your body and its natural equilibrium. You should be aware of negative factors like high-fat diets, which can lead to serious health disorders. You have a personal responsibility for your own good health. You only have one body. Take good care of it!

25

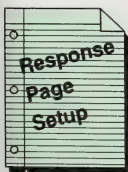
Section 2 Assignment: Nutrition

Review the Evaluation information found in the introductory pages of this module.

It is important to number and clearly identify each page with the following information at the top:

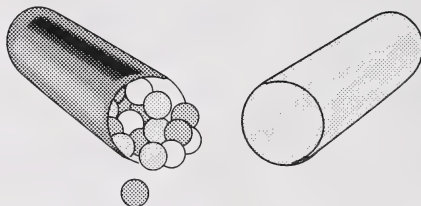
Biology 20 – Module 6 Section 2 Assignment Page # Name and ID#

Be sure to write legibly. Leave a wide left margin and number all of your pages.

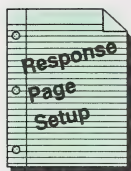


1. Explain how a diet lacking in lipids could cause a vitamin deficiency. (5 marks)
2. Compound X is being tested as a harmless drug capsule material for use in delivering medications to the small intestine.

The capsule must pass unharmed through the stomach but dissolve upon reaching the small intestine.



- a. Describe how you could test Compound X for sensitivity to the appropriate digestive enzymes. (5 marks)
- b. What is the best substance to use when making Compound X – a protein, a carbohydrate, or a lipid? (5 marks)



3. Amylase is an enzyme which breaks down starch into units of glucose. Predict the results in each of these test tubes if tested with Benedict's solution, biuret reagent, and iodine. Place your answer in chart form as shown. (10 marks)



TEST TUBE	BENEDICT'S	BIURET	IODINE
a			
b			

A Breath of Life



WESTFILE INC.

When you go swimming, how long can you stay under water without coming up for air? When you were a young child did you ever try holding your breath until your parents gave in to your demands? How long did you last?

How long can you hold your breath now? About a minute is the average for most people. This means that for your entire life you'll likely never go more than one minute without breathing.

In this section you will investigate the process of breathing. You'll study gas exchange between your body and your external environment. You will also explore the effects of smoking on your respiratory system. Finally you will consider some views of life and death as combinations of living systems.

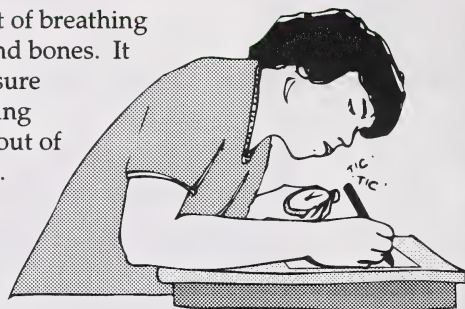
ACTIVITY

1

Breathing and Gas Exchange

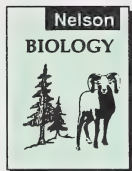
Breathing is a very mechanical activity. The act of breathing requires the coordination of nerves, muscles, and bones. It relies on atmospheric pressure, that is, air pressure outside the body. For many organisms, including humans, breathing requires moving air in and out of the lungs. So the mechanics must be reversible.

Obtain a pencil and sheet of paper. Sit where you can observe a watch or clock. For exactly one minute, record with a check mark (✓) each time you breathe in. At the end of one minute, total the check marks.



1. How many times did you breathe?
2. Calculate how many breaths you'd take in one hour, in one day, and in one year.

Physically, what does breathing involve?



Read the section entitled Importance of Breathing on page 296 in your text for an introduction.

3. a. What is the most common gas in the atmosphere?
- b. Do you breathe this gas?
- c. Does this gas normally affect you?
- d. What is the second most common gas?
- e. How does this gas affect you?

Your respiratory system consists of many parts besides just your lungs. Turn to your text and read The Human Respiratory System on pages 297 to 299. Also observe the diagram in Figure 12.3.

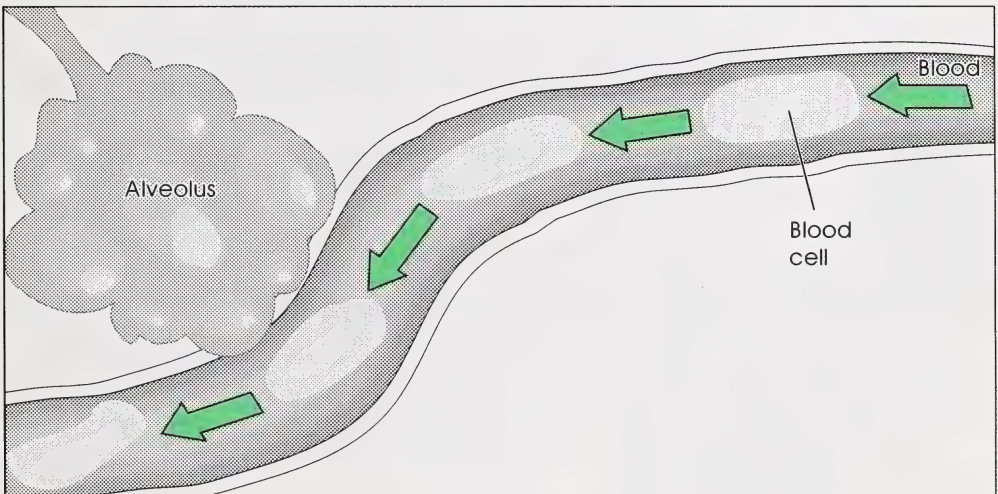
4. What structure initially cleans, moistens, and warms air taken in?
5. What is the proper name for the back of the throat?
6. From the pharynx which structure leads to the lungs? the stomach?

Science Skills

- ☒ A. Initiating
- ☐ B. Collecting
- ☒ C. Organizing
- ☒ D. Analysing
- ☐ E. Synthesizing
- ☐ F. Evaluating

7. Choking can occur if food or other substances enter the trachea. What structure exists to close the glottis during swallowing?
8. Speculate as to the function of the rings of cartilage in the trachea. Incidentally, in mammals the rings are C-shaped, but in birds the rings are O-shaped.
9. Where does gas exchange between the atmosphere and the body finally occur?
10. Make a list of the primary structures that convey air in the respiratory system.
11. Air enters and leaves the lungs. What crosses the alveolar membranes between the alveoli and the blood?
12. Does air go into the blood from the lungs? Explain your answer.
13. On the following diagram of an **alveolus**, use arrows to indicate the direction of the movement of carbon dioxide, oxygen, and water.

alveolus -- small air sac in the lungs where gas molecules diffuse in and out of the blood



14. By what process do molecules move between the alveoli and the blood?
15. Where does the carbon dioxide come from?
16. What is the advantage of having millions of tiny air sacs in the lungs instead of just one large air sac?
17. Why does a cold window or mirror fog up when you breathe onto it?

Your respiratory system is set up to take oxygen from the atmosphere and release water and carbon dioxide to the atmosphere. Look at the following equation:



18. a. What body system provides $\text{C}_6\text{H}_{12}\text{O}_6$?
- b. What system provides 6O_2 ?

Check your answers by turning to the Appendix, Section 3: Activity 1.

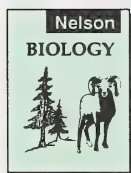
ACTIVITY

2

Mechanics of Breathing

How does your respiratory system ensure that air moves in and out of the lungs?

There is nothing in the lungs that is physically capable of moving air in or out. Your lungs can't breathe! All they do is provide a large surface area. Other structures must move air in and out of the lungs.



Take a careful look at Figure 12.3 on page 298 of your text. Notice the ribs and diaphragm. You can also check Figure 12.5 on page 300.

1. What are between the ribs?

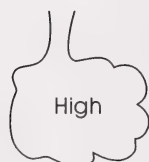
Read Breathing Movements on pages 299 and 300 of your text and answer the following questions.

2. What determines the movement of air between the atmosphere and the lungs?
3. Use arrows to indicate the probable direction of air flow in the following diagrams.

- a. High



- b. High



- c. Low



- d. Low



Since atmospheric pressure is relatively constant, the respiratory system must change the relative gas pressure in the lungs to cause air exchange.

4. What factor does the respiratory system use to control air pressure in the lungs?
5. a. If the volume in the chest cavity increases, what will happen to pressure?
b. How will pressure respond if volume decreases?
6. Use arrows to indicate the relationship between volume and pressure in the following:

↑ V:P ____ ↓ V:P ____

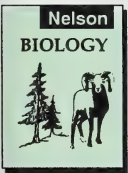
7. a. What two active structures work together to control the volume of the chest cavity?
b. What structures passively assist breathing?

Figure 12.5 on page 300 of your text illustrates coordination between the diaphragm and the **intercostal muscles**. Next time you sit down to a meal of barbecued ribs notice how long and stringy intercostal muscles are. They are meant to pull the ribs closer together.

8. a. Which direction do the ribs move when the intercostal muscles contract?
b. How does this affect the volume of the chest cavity?

The intercostal muscles are used for increased breathing, for example, during exercise. Normal, relaxed breathing only uses the diaphragm.

9. a. Which way does the diaphragm move when you breathe in?
b. How does this movement affect chest cavity volume?
c. How does this affect the air pressure in the chest cavity relative to atmospheric pressure?
10. a. Which way does air move when the diaphragm contracts and moves downwards?
b. What force causes air to move this way?



intercostal muscles – muscles between the ribs

11. Complete this table to summarize breathing movements.

	INSPIRATION	EXPIRATION
Diaphragm		
Ribs		
Intercostal muscles		
Chest cavity pressure		
Atmospheric pressure relative to chest cavity pressure		

Check your answers by turning to the Appendix, Section 3: Activity 2.

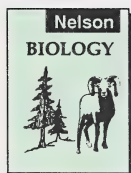
By now you can appreciate your respiratory system as an important component in your life. Go on to the next activity keeping in mind the importance of your respiratory system.

ACTIVITY

3

Smoking and You

This symbol is found in many places. Today many public areas have been identified as non-smoking. Why?



The smoking issue is a complex one. Read the passage entitled Social Issue: Smoking on page 311 of your text to examine various viewpoints. How do you feel about smoking? Of the points and counterpoints given, which do you think is the most important overall?

No matter what your position is on smoking, you should know about its physiological effects.

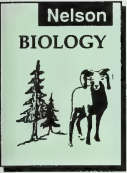
1. Read through the Case Study on page 310 of your text and answer Procedure questions 2. (a), 3. (b), 4. (c), 5. (d), and 6. (e).

Check the answers in the Appendix for the Procedure questions before going on to the Case-Study Application Questions.

2. Do the textbook Application questions 1 and 2.

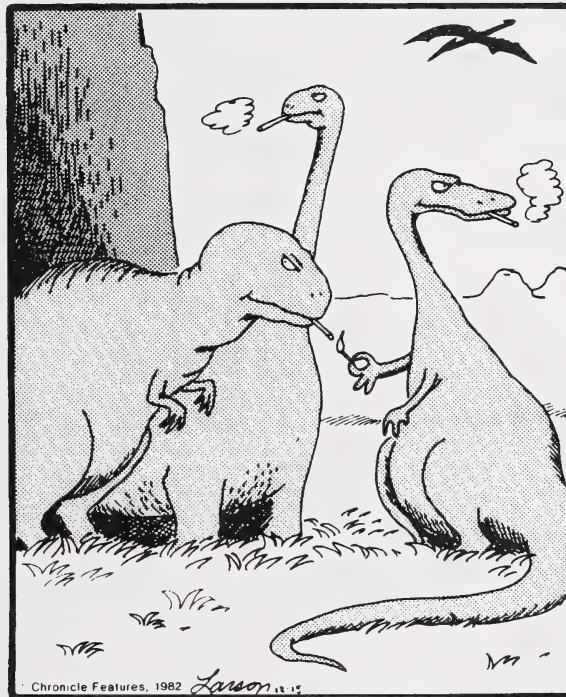
Check your answers by turning to the Appendix, Section 3: Activity 3.

Observe Figure 12.9 on page 304 in your text. Notice the size of the tumor in the photo of the lung. Also notice the black, tarry deposits throughout the rest of the lung.



THE FAR SIDE

By GARY LARSON



The real reason dinosaurs became extinct

3. If you smoke one package of cigarettes a day and you spend \$5.00 per package, how much will you have spent in one year? ten years?

As you can see, the cost of smoking is great – both physiologically and financially.

Check your answers by turning to the Appendix, Section 3: Activity 3.

¹ The Far Side cartoon by Gary Larson is reprinted by permission of Chronicle Features, San Francisco, CA. All rights reserved.

ACTIVITY

4

Somebody Cares

On a lonely highway east of Medicine Hat a van goes out of control and rolls. The nineteen-year-old driver, who is not wearing a seatbelt, is thrown from the vehicle and lands unconscious in the ditch. His neck is broken; brain injury is massive. An hour later in hospital he is on life support systems, but it's a losing battle. All brain activity has stopped.

It's all very sudden and very tragic, but his younger sister remembers a conversation the family had last summer. It was about organ donation. Her brother had made it clear that if anything ever happened to him, he wished his organs to be donated. And, he had signed the organ donation card on his driver's licence.

A brief conference is held with the attending physician. Though still very upset about his death, the family agrees to organ donation. "It's what he would have wanted."

Suddenly there's hope. In Calgary, a young person may see again because of transplanted corneas. In Edmonton, a young father will be freed from a dialysis machine by a kidney transplant. And in Vancouver, a transplanted heart valve may save the life of a sixteen-year-old girl who had only a few months to live. The young driver dies but three other people live, and live better. They'll never know who the donor was, just that out there somewhere somebody cares.

1. What important steps that occurred in this story led to a successful organ donation?

Investigation: Hope

Purpose

This investigation will introduce you to organ and tissue donation. This represents a true benefit from the cooperation of science, technology, and society.

Materials

Brochure: *Organ & Tissue Donation*. The brochure is a publication of the Human Organ Procurement and Exchange Program (H.O.P.E.) available at University of Alberta Hospitals and Foothills Hospital in Calgary.

Procedure

Read the brochure and answer the following questions.

2. What two conditions must be met before an organ donation can be considered?

3. Name the tissues and organs that are described as suitable for transplant.
4. What other tissue is in great demand for transplant? Hint: The Red Cross is especially helpful in this program.
5. Besides transplantation to a living person, what other important use can be made of organs and tissues?
6. What three centres can be contacted for more information?
7. When was the first kidney transplant done in Alberta?
8. Heart and lung transplants are medically complex. Describe when patients may be referred for such procedures.
9. Describe the two types of kidney transplants.
10. What does bone marrow do in the body?
11. What diseases may be treated with a bone marrow transplant?
12. Next to blood transfusion what is the most frequent transplant?
13. What other tissues are needed for ongoing research projects in Alberta?

Check your answers by turning to the Appendix, Section 3: Activity 4.

Organ and tissue donation is a big decision. People must make this decision for themselves. But think of it this way, the decision to give is free anytime; the decision to receive can happen by accident. Be sure to read over the section in the brochure entitled *Your Questions*.

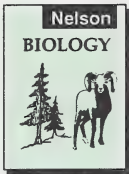


If you have access to the video *Have You Considered Organ Donation?* watch the video and discuss organ donation within your family. This video is available from the Kidney Foundation of Canada.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help



1. Match the following tissues and organs to their functions in breathing. Refer to your text pages 297 to 298 if you need help.

Tissues and Organs

- a. capillary
- b. intercostal muscle
- c. epiglottis
- d. diaphragm
- e. alveoli
- f. larynx
- g. trachea
- h. cartilaginous "C" rings
- i. esophagus

Functions

- (1) carries food to stomach
- (2) is another name for windpipe
- (3) prevents food from entering windpipe
- (4) is another name for voice box
- (5) are rings that hold windpipe open
- (6) is muscle between ribs
- (7) is muscle under chest cavity
- (8) are tiny air sacs in lungs
- (9) is tiny blood vessel

2. Label each statement either **I** for inhalation or **E** for exhalation.

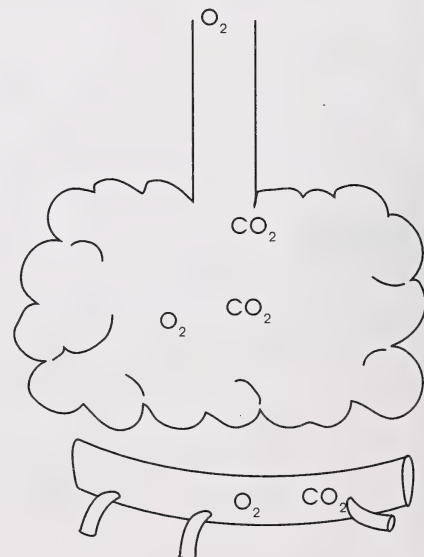
- a. The air pressure is higher on the inside of the lungs.
- b. The volume of the chest cavity is increased.
- c. Your chest muscles pull in your rib cage.
- d. Your diaphragm moves down.
- e. Your rib cage moves up and out.

Your respiratory system is designed so that you can exchange gases with the atmosphere.

Diffusion takes place in the alveoli, the tiny air sacs deep inside your lungs. When you smoke, you inhale other substances which also enter into your lungs and may diffuse into the blood.

As you already know, air contains oxygen, which must be supplied to your cells. Why do your cells need oxygen? If you're not sure, refer back to Module 5 to review cellular respiration.

3. To illustrate the diffusion of the gases in your lungs, place arrows beside the gases to show their movement.



Breathing involves two stages. Inhalation allows you to breathe in air and exhalation allows the reverse.

4. Develop a chart similar to the one here to show what happens when you breathe.

	VOLUME OF LUNGS	PRESSURE IN LUNGS	MOVEMENT OF RIB CAGE	MOVEMENT OF DIAPHRAGM
Inhalation				
Exhalation				

Unfortunately, people do stop breathing and die as a result of it. Once their tissues run out of oxygen and build up too much carbon dioxide, they are no longer able to function.

Check your answers by turning to the Appendix, Section 3: Extra Help.

Enrichment

Do one or more of the following activities.

- If you have access to the book *One-Minute Readings: Issues in Science, Technology, and Society*, read

- Issue 1 Definition of "Life"
- Issue 25 Organ Transplants

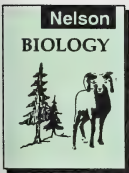
Using these two articles to help you to summarize your own views on these topics, compile a one-page paper.

- A spirometer is a device which enables you to measure the volume of air moving in and out of your lungs. You can see this on page 305 of your text.

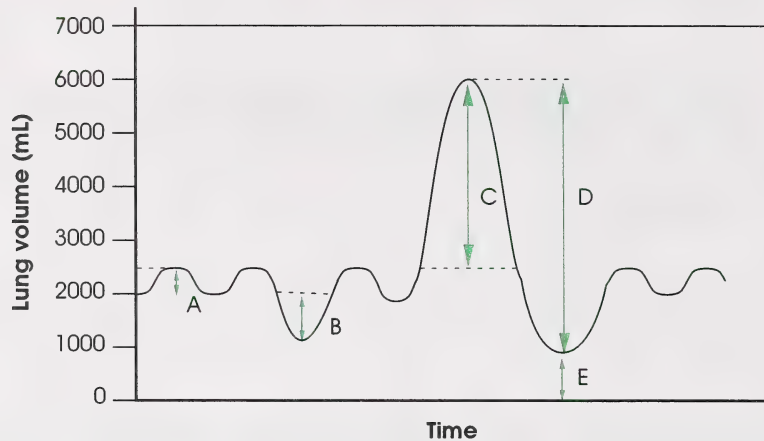
If you measure the normal amount of air you are breathing during a normal breath, you are measuring your tidal volume.

However, you know that you can breathe much more than that amount. When you take a big breath, you take in a lot more air. That amount is your inspiratory reserve volume. Blowing out as much air as you can, can be measured also. This is your expiratory reserve volume. That little bit that always remains in your lungs is your residual volume.

When you add up all these volumes, the result is your total lung capacity.



Using the graph that follows, calculate the approximate volumes if your total lung capacity is 6000 mL.



A = Tidal volume
B = Expiratory reserve volume
C = Inspiratory reserve volume
D = Vital capacity
E = Residual volume

3. Visit an ambulance facility or firehall and ask to see the equipment used for emergency resuscitation.
4. Write to the Kidney Foundation at the following address and ask for information about organ transplants.

The Kidney Foundation of Canada
Edmonton and Northern Alberta Chapter
11574 – 149 Street
Edmonton, Alberta
T5M 1W7

5. Write to H.O.P.E. at the University of Alberta Hospitals at the following addresses and ask for more information.

Human Organ Procurement and Exchange
University Hospitals
8440 – 112 Street
Edmonton, Alberta
T6G 2B7

Foothills Hospital
1403 – 29th Street N.W.
Calgary, Alberta
T2N 2T9

Check your answers by turning to the Appendix, Section 3: Enrichment.

Conclusion

Breathing is a basic life function. You can usually survive several days without water and possibly several weeks without food. Without breathing, a human can only hope to live a few minutes. Why is breathing so vital? Think back to respiration in Module 5. Breathing provides oxygen, an electron acceptor needed for converting nutrients into ATP. You need a constant supply of ATP but you store very little; therefore you need a constant supply of oxygen. Breathing also rids the body of carbon dioxide and to some extent, excess heat. It's no wonder that respiratory problems created by smoking and diseases such as cancer have serious consequences. Your respiratory system is hard to replace so you should take good care of it.

35

Section 3 Assignment: A Breath of Life

Review the Evaluation information found in the introductory pages of this module.

It is important to number and clearly identify each page with the following information at the top:

Biology 20 – Module 6 Section 3 Assignment Page # Name and ID#

Be sure to write legibly. Leave a wide left margin and number all of your pages.

- Using the relationship between volume and pressure in the atmosphere and in the chest cavity, describe the course of expiration. Include the role of the diaphragm in your answer. **(10 marks)**
- Describe two reasons why the human respiratory system would work very poorly in a low pressure environment. **(10 marks)**
- Compare the relative amounts of oxygen, carbon dioxide, nitrogen, water vapours, and heat in exhaled air. Design a table of comparisons. You may use terms such as *higher, lower, more, or less* in your answer instead of numerical values. **(10 marks)**

Reproduce the science skills assessment box after your response to this question. Remember to indicate your evaluation of your skill level for each identified science skill. Be sure to include the spaces for teacher assessment.

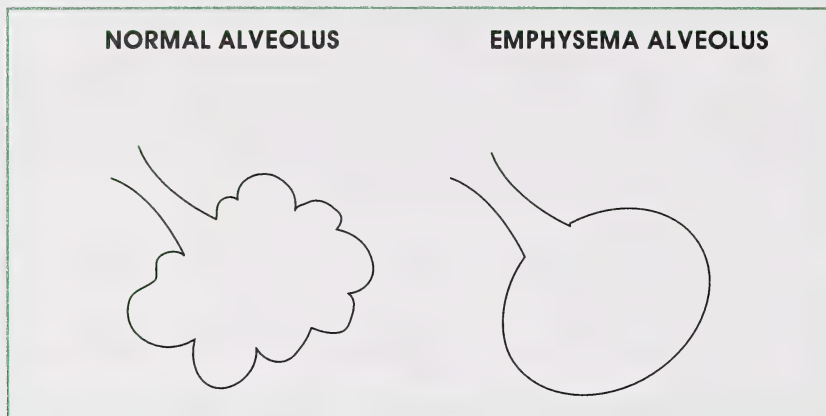
Self: A.	☐	B.	☐	C.	☐	D.	☐	E.	☐	F.	☐
Teacher: A.	☐	B.	☐	C.	☐	D.	☐	E.	☐	F.	☐



Science Skills

- ☐ A. Initiating
- ☐ B. Collecting
- ☐ C. Organizing
- ☐ D. Analysing
- ☒ E. Synthesizing
- ☐ F. Evaluating

4. Emphysema is a disease of the respiratory system where the walls of the alveoli break down. This may temporarily increase the volume of the air sacs. Examine these two diagrams and predict why oxygenation of the blood is less efficient in people with emphysema. (5 marks)



MODULE SUMMARY

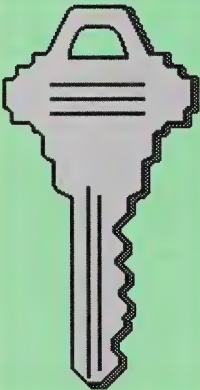
Your digestive and respiratory systems exchange matter and energy with the environment. Notice that exchange implies movement in two directions. In this module you studied the acquisition of materials necessary for life. In the next module you'll investigate the circulatory system that delivers these materials to cells and the excretory system that keeps the body in chemical balance.

To ensure that all of your work has been completed in a satisfactory manner, check off the items in the following list:

- ☐ Section 1 Assignment has been completed.
- ☐ Section 2 Assignment has been completed.
- ☐ Section 3 Assignment has been completed.
- ☐ Your responses are organized and neat, with room for teacher comments.
- ☐ All your response pages are numbered consecutively and identified with this heading

Biology 20 -- Module 6 Section # Assignment Page # Name and ID #

Appendix

	Glossary
	Activities
	Extra Help
	Enrichment

Glossary

alveolus: small air sac in the lungs where gas molecules diffuse in and out of the blood

anorexia nervosa: an abnormal psychological state where a person loses all desire for food, and as a result severe weight loss occurs

cellulose: the main part of the cell wall in all plants; humans cannot digest cellulose

denatured: to be made inactive
Heat changes the shape of proteins.

HCl: hydrochloric acid
This acid lowers the pH in the stomach to about 2.0. At this pH pepsinogen changes into pepsin which digests protein.

inorganic: does not contain carbon atoms

intercostal muscles: muscles between the ribs

irradiation: a process which destroys microorganisms by exposing substances to cobalt-60, a radioactive isotope

organic: contains carbon atoms

Suggested Answers

Section 1: Activity 1

1. Jaws, teeth, and tongue are involved in the initial physical breakdown of food.
2. Chewing increases the surface area of food enabling the enzymes to begin chemical breakdown.
3. Saliva lubricates food particles and the enzyme contains amylase, which starts the breakdown of starch.
4. Peristalsis is a wave of muscular contractions which moves food through the digestive tract.
5. Food would enter your trachea and lungs, and you would choke.
6. HCl creates a low pH (2.0) which changes pepsinogen into pepsin and also activates mucus production. Pepsin digests protein; mucus protects the stomach lining.

7.

SECRETION	FUNCTION
Pancreatic amylase	continues digestion of carbohydrates
Lipase	digests lipids
Trypsin	digests proteins
Sodium bicarbonate	neutralizes acidic contents

8. Bile salts break down (emulsify) fats into fine droplets which can then be chemically broken down by lipase.

9. Amino acids and sugars diffuse into the blood and fats diffuse into lymph vessels. The circulatory system carries these nutrients throughout the body where diffusion moves the nutrients into individual cells.
10. Water, salt, minerals, and vitamins are all absorbed by the large intestine.
11. Humans lack the appropriate enzymes for the chemical digestion of cellulose.
12. Fibre retains water and maintains bulk in any undigestible material. This keeps waste material moving along the intestine.

Section 1: Activity 2

1. Saliva contains the enzyme amylase and it starts the breakdown of starch.
2. Enzymes enable chemical reactions to occur by lowering the energy required to complete the reaction.
3. An enzyme is a substance that causes a reaction. The substrate is the actual reactants in the reaction. Review page 180 in your text and look at Figure 7.8.
4. Each enzyme will only react with a single type of substrate. This specificity is based on shape and molecular structure of both enzyme and the substrate. This is the lock and key theory. Consider an enzyme as a key and substrate as the lock.
5. Temperature, pH, and concentration of the substrate all affect enzymes.
6. Optimal temperature means the temperature at which the most reactions will occur.
7. Enzymes are proteins and will change shape at high temperatures. The new shape will not join with the substrate.
8. A change in pH will alter the hydrogen bonds in an enzyme and cause a change in the shape of the enzyme.
9.
 - a. The line levels off because the number of substrate molecules exceeds the number of enzyme molecules. The enzyme is working at its fastest rate given the concentration of substrate.
 - b. Adding more enzyme will now increase the reaction as the increased enzyme will match the increased substrate.

10. Room temperature	gelatin softened a lot
Ice-cold	gelatin softened very little
Hot	gelatin remained solid

11. The gelatin starts to break down into a less complex molecule. It loses its consistency as a nearly solid substance.
12. The heat would destroy the enzyme and therefore it would not soften the gelatin.
13. No, because the heat would destroy the enzyme in the tenderizer and it would no longer act on protein or tenderize the meat.

14. • Textbook question 1: Test tubes 1, 3, and 5 served as controls.
- Textbook question 2: Pepsin works best at a pH of 2 to 3.
- Textbook question 3: No. Digestion occurred where HCl was present with pepsin. Where pepsin or HCl were alone, no digestion occurred. So digestion depends on a combination of pepsin and HCl.
- Textbook question 4: The alkaline environment would not affect the digestion of fats. Carbohydrates, along with amylase added in the mouth, would continue to break down in the stomach. Proteins would not break down in the stomach since protein digestion requires a low pH.
15. Because antacids neutralize acidity, the pepsin will no longer function properly and therefore protein digestion will not occur.

Section 1: Follow-up Activities

Extra Help

1. a. mouth f. stomach k. small intestine
b. small intestine g. small intestine l. duodenum
c. large intestine h. stomach m. appendix
d. duodenum i. pancreas n. large intestine
e. liver j. stomach o. gallbladder
2. a. Enzymes may break molecules apart as in digestion or put molecules together as in building new protein.
- b. B – small intestine
C – large intestine
A – stomach

3.	ORGAN	SECRETIONS	COMPONENTS	ACTION
	Mouth	saliva	mucus	lubricates
			amylase	breaks down carbohydrates
	Stomach	gastric juice	HCl	activates conversion of pepsinogen to pepsin
			rennin	curdles milk
			pepsin	breaks down proteins into polypeptides
	Liver	bile	bile salts	emulsifies fats

ORGAN	SECRETIONS	COMPONENTS	ACTION
Pancreas	pancreatic juice	sodium bicarbonate	neutralizes acids
		amylase	breaks down starch
		lipase	breaks down fat
		trypsin	breaks down protein
		peptidases	breaks down peptides into amino acids
Small intestine	intestinal juice	maltase	breaks down maltose
		lactase	breaks down lactose
		sucrase	breaks down sucrose
		enterokinase	activates trypsinogen
		peptidases	breaks down peptides into amino acids

Enrichment

- Colitis is an inflammatory disease of the large intestine which is characterized by bloody diarrhea. An X-ray examination reveals tiny ulcers, a thickening of the colon, and a loss of normal peristaltic ability. Treatment can include a bland diet, medications, or in severe cases, surgery.

Ileitis involves an inflammation of the small intestine, pain and fever, and diarrhea. Treatment is similar to that for colitis.

Allergies and hypersensitivity seem to be implicated in both diseases. There is a strong possibility that certain people are sensitive to the substances in food. When these disorders exist, digestion is affected. Absorption of water and nutrients is inhibited, and as a result diarrhea occurs. This can severely malnourish the affected individual.

- The use of alcohol and drugs is strongly implicated in liver disease, because the liver functions to rid the body of these substances. Eating an abundance of additives may also be a concern, as the liver would also be involved in breaking down these types of substances.

Recommended diets are those diets which include all the necessary essential nutrients, vitamins, and minerals.

- If you do receive information, be sure to write a thank-you note.
- While watching the video, take careful notes on how diet can influence the health of the heart and circulatory system.

Section 2: Activity 1

- Only plants can manufacture carbohydrates from carbon dioxide and water.
- Sugar is another common name for a basic carbohydrate.
- Carbohydrates are classified according to their numbers of sugar units or saccharides.

4. Plants store most carbohydrates as starch.
5. Animals store carbohydrates as glycogen. The liver converts glucose to glycogen and vice versa.
6. Benedict's solution contains Cu^{2+} ions that change to Cu^+ ions in reducing sugar. They also change colour.
7. The substance does not contain sugars (reducing sugars).
8. • Textbook question 2. (a): This may result in the mixing of some of the solutions and could cause inaccurate results.
- Textbook question 3. (b):

SOLUTION	INITIAL COLOUR	FINAL COLOUR	% SUGAR
Water	blue	blue	0%
Glucose	blue	yellow, orange, or red	1.0 – 2.0%
Fructose	blue	yellow, orange, or red	1.0 – 2.0%
Maltose	blue	yellow	1.0 – 1.5%
Sucrose	blue	blue	0%
Starch	blue	blue	0%

Textbook question 4. (c): Iodine in water will turn a dilute yellow colour.

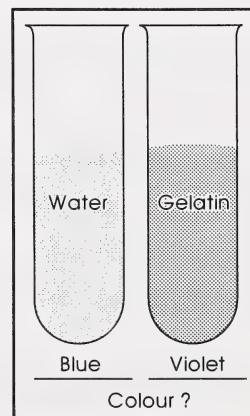
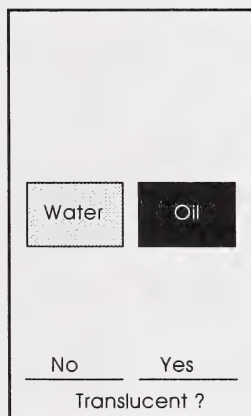
Textbook question 5. (d): starch +
 glucose –
 maltose –
 sucrose –

Only starch reacts positively with iodine and turns a dark purple.

Section 2: Activity 2

1. Lipids store energy.
2. Energy is stored in lipids once glycogen storage has been built up.
3. Lipids are a component of cell membranes, can help transport vitamins, and act as cushions in supporting body organs.
4. Lipids make up triglycerides, phospholipids, and waxes.
5. Triglycerides form fats and oils in animals and plants.
6. Proteins also contain nitrogen and sulphur.
7. Basically proteins are composed of amino acids.
8. Digestion of the beef protein yields amino acids. These are reassembled into human protein.
9. a. The human body can produce twelve of the twenty known amino acids.
- b. The remaining eight amino acids must be part of the diet. They must come from food and so are called essential amino acids.

10. Amino acids are joined together with peptide bonds to form long chains of polypeptides. Enzymes that break these bonds and so digest proteins are sometimes called peptidases.
11. a. The protein test is called a biuret test.
b. Biuret reagent reacts with peptide bonds.
12. Lipids can be identified by a Sudan IV test and a translucence test.
13. a. In a positive Sudan IV test, the lipid will dissolve in the Sudan IV solution and turn red.
b. In a positive translucence test, brown paper becomes clear or translucent.
c. In a positive biuret test the light blue biuret turns pink or even purple.
14. If tested with Sudan IV, an enzyme would be negative. Enzymes are proteins, not lipids. As a protein, an enzyme would give a positive biuret test result.
15. • Textbook question 2. (a): • Textbook question 4. (b): • Textbook question 5. (c):



Textbook question 6. (d):

SOLUTION	SUDAN IV	TRANSLUCENCE	BIURET
Glucose	—	—	—
Gelatin	—	—	+
Soap	+	+	—
Egg	—	—	+
Detergent	+	+	—

Your results for solutions X, Y, and Z will vary depending on what you choose for solutions.

16.

SUBSTANCE	TEST SOLUTION	INITIAL COLOUR	POSITIVE TEST COLOUR
Reducing sugar	Benedict's	blue	green → red
Starch	Iodine	orange-brown	blue black
Protein	Biuret	blue	violet → purple
Lipid	Sudan IV	dark red	bright red

17. Carbohydrates would be the best, but the type of carbohydrates chosen, which could be starches like pasta and potatoes or sugars like chocolate or fruit juice, would also be important. This is why nutrition is a big part of coaching in many sports.

Section 2: Activity 3

- Carbohydrates would produce the most energy, then fats, and lastly proteins.
- Five grams of dehydrated apple would produce more energy because gram for gram it contains more carbohydrate. In five grams of fresh apple, some of the mass is water which produces no energy.



5 g
fresh apple

=

3 g
carbohydrate
2 g water



5 g
dehydrated apple

=

5 g
carbohydrate
0 g water

Section 2: Activity 4

- You would have a lack of energy which would have a significant effect on your general health. Fatigue would be the major symptom.
- Liver, fish, green vegetables, and whole grain cereals are good sources of multiple vitamins.
- Anemia may result from an iron deficiency.
- Loss of calcium from bones causes osteoporosis. You may have given phosphorus as an answer because it is required for teeth and bones too. However, calcium is the mineral involved in this particular disease.
- Milk, cheese, cereals, and beans are good sources of calcium.

Section 2: Activity 5

- Without additives, food manufacturers claim that many foods would spoil and be of no use or cause a great deal of illness. Food could not be stored for long periods or transported for long distances.

2. Sample Letter

Dear Manufacturer,

"Crunchios" is one of my favourite cereals. However, yesterday I was reading the side of the box and noticed that you add BHT to the cereal.

I am concerned about additives in the food I eat. I would like to find out from you why your company adds BHT to this cereal product. Please write back to me concerning this matter.

Yours truly,

(Your Signature)

- You might have recommended irradiation as the better method of food preservation because it has no effects on nutrients in foods. However, the use of radioactive materials is strictly prohibited, so freezing would be a more common method used.

Section 2: Activity 6

- If the food intake exceeds the energy output, you may gain weight.
- People eat more fast foods today. Because they live in a technical age rather than an agricultural age, they need less energy for their basic needs. They also have more leisure time, which they don't necessarily use for physical activity.
- Excess weight puts a greater strain on your heart and causes it to pump harder, thereby increasing blood pressure. Because you are larger, you develop a greater network of blood vessels in your body. Fat deposits can build up in the arteries reducing blood flow and adding more strain on the heart.
- Fat should not contribute more than 30% total energy.
- Prostate cancer, breast cancer, colon cancer, diabetes, and heart disease may all be linked to excess dietary fat.
- HDL, high-density lipoproteins, are beneficial. Fibre also helps to reduce cholesterol.
- Some diets can contribute to malnutrition. Some diets include appetite suppressants. Some diets can lead to fatigue and increased susceptibility to illness and injury.

Section 2: Follow-up Activities

Extra Help

- | FOOD | CHEMICAL GROUP | CHEMICAL TEST |
|---------------|----------------|-----------------------|
| Margarine | lipid | Sudan IV/translucence |
| Fish | protein | Biuret |
| Sugar | carbohydrate | Benedict's |
| Gelatin | protein | Biuret |
| Peanut butter | lipid | Sudan IV/translucence |
| Apple | carbohydrate | Benedict's |

2. C
3. D
4. A
5. B

6.

ESSENTIAL NUTRIENT	VITAMIN	MINERAL	ADDITIVE
carbohydrate	niacin	calcium	BHA
lipid	thiamine	iron	gelatin
glucose	vitamin C	magnesium	wintergreen
protein	riboflavin	iodine	artificial colour

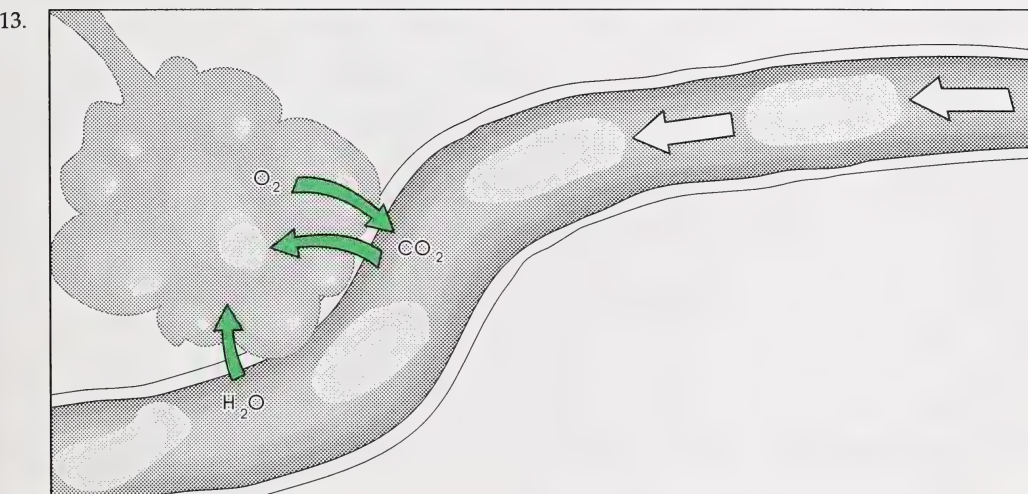
Enrichment

1. Once all the foods or portions of foods have been identified as carbohydrates, proteins, or fats, you should calculate what percentage of your diet these nutrients constitute. To assist you with identifying the vitamins and minerals, use the charts provided. Nutritional summary charts are helpful to do a more accurate analysis of your diet.
2. Consumer education is vital to acceptance of this process. Public awareness can be heightened by television advertisements and displays at shopping centres. The advantages of using this process must be strongly emphasized. The following are advantages of using this process:
 - Microorganisms are effectively destroyed.
 - The process is very fast.
 - The texture and flavour of foods are not altered.

Section 3: Activity 1

1. You probably breathed about ten to twelve times per minute. Were you nervous? If so, you would breathe faster. Were you relaxed? If so, you would breathe slower.
2. At twelve breaths per minute, you would take 720 breaths per hour, 17 280 breaths per day, and 6 307 200 breaths per year.
3.
 - a. Nitrogen is the most common gas in the atmosphere. It composes 78% of the atmosphere.
 - b. Yes, every breath you take contains 78% nitrogen.
 - c. Usually nitrogen has no affect on you. You breathe it in and you breathe it out all the time.
 - d. Oxygen is the second most common gas as it composes about 21% of the atmosphere.
 - e. Oxygen is necessary for cellular respiration. Life ends very quickly without oxygen.
4. The nasal cavity cleans, warms, and moistens air.

5. The pharynx is the back of the throat.
6. The trachea leads to the lungs. The esophagus leads to the stomach.
7. The epiglottis closes the glottis to temporarily seal the trachea.
8. The rings of cartilage support the trachea and keep it open during breathing. Without the rings of cartilage, the trachea would collapse when you tried to breathe in.
9. Actual gas exchange occurs in the alveoli.
10. The primary structures are
 - nasal cavity • glottis • trachea • bronchi
 - pharynx • larynx • bronchioles • alveoli
11. Air enters and leaves the lungs as a gas. Individual molecules of oxygen, carbon dioxide, nitrogen, and water cross the alveolar membranes between the alveoli and the blood.
12. No, actual air doesn't enter the blood only individual molecules of oxygen enter it.



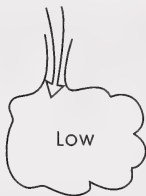
14. The molecules move between the alveoli and the blood by diffusion.
15. Carbon dioxide comes from your cells. It is produced during cellular respiration.
16. This increases the surface area for the exchange of gasses and therefore more exchange can occur.
17. Condensation occurs because you are also breathing out warm water vapour. As the warm vapour cools on the window or mirror, it condenses into a liquid.
18. a. The digestive system provides $C_6H_{12}O_6$ (carbohydrates).
- b. The respiratory system provides $6 O_2$ (oxygen).

Section 3: Activity 2

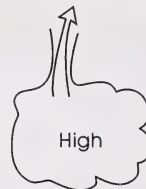
1. Muscles lie between the ribs. These are called intercostal muscles.

2. Air moves because of differences in pressure.

3. a. High



c. Low



b. No movement High



d. No movement Low



4. The respiratory system uses volume to control air pressure in the lungs.

5. a. If the volume in the chest cavity increases, pressure will decrease in the chest cavity.

b. Pressure will increase if volume decreases.

6. $\uparrow V:P \downarrow$ $\downarrow V:P \uparrow$

7. a. The diaphragm and intercostal muscles work actively to control chest cavity volume.

b. The ribs passively assist breathing.

8. a. The ribs are pulled closer together and move upwards and outwards when the intercostal muscles contract.

b. This increases the volume of the chest cavity.

9. a. The diaphragm moves down.

b. Chest cavity volume is increased.

c. Air pressure in the chest cavity decreases.

10. a. Air moves into the lungs when the diaphragm contracts and moves downwards.

b. Relatively higher atmospheric pressure forces air into the lungs.

11.

	INSPIRATION	EXPIRATION
Diaphragm	moves down	moves up
Ribs	move up, out	move down, in
Intercostal muscles	contract	relax
Chest cavity pressure	decreases	increases
Atmospheric pressure relative to chest cavity pressure	higher	lower

Section 3: Activity 3

- Textbook question 2. (a): The mucus layer is much thicker in Diagram B because of constant irritation by smoke particles.
 - Textbook question 3. (b): The buildup of tar causes an increase in mucus that narrows the bronchi.
 - Textbook question 4. (c): The tumor begins in the basal cells.
 - Textbook question 5. (d): The mucus layer is now thinner because the goblet cells are affected.
 - Textbook question 6. (e): Cancer in the lungs may spread to other organs and organ systems.
- Textbook question 1: Smokers often have a cough because of increased mucus buildup in the lungs and impaired ciliary action.
 - Textbook question 2: As the cilia become impaired, the ability to remove heavy mucus full of tar and smoke particles is reduced. These irritants remain in the lungs and build up.
- In one year you will spend $\$5.00 \times 365 \text{ days} = \$1\,825.00$.
In ten years you will spend $\$1\,825.00 \times 10 \text{ years} = \$18\,250.00$.

Section 3: Activity 4

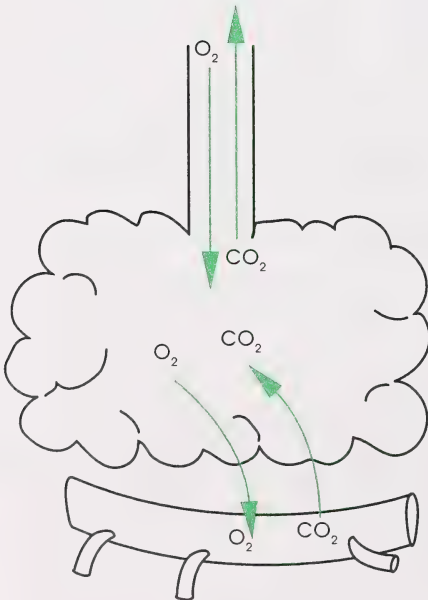
- An important step was taken when the family discussed organ donation. The next important step was when the young driver signed his organ donor card.
- The donor must have signed a donor card and all family members must be agreed on donation.
- Corneas, heart valves, lungs, kidneys, liver, pancreatic islets, bone and bone marrow, and skin can be transplanted.
- Blood and blood products are commonly donated and transplanted.
- Besides transplantation, organs and tissues are needed for research.
- Information is available from Human Organ Procurement and Exchange at the University Hospital, Lion's Eye Bank, and the Canadian Red Cross Society. The Kidney Foundation of Canada (Edmonton and Northern Alberta Chapter), Canadian Liver Foundation, Canadian Diabetes Association, and the Cystic Fibrosis Foundation can also be contacted.
- The first kidney transplant was done in 1967.

8. Patients are referred when conventional medical and surgical treatments are no longer effective.
9. One type is a cadaveric transplant performed with a kidney from a donor who has been declared brain dead. Another type is a transplant from a living relative who donates one of their kidneys.
10. Bone marrow makes red and white blood cells and platelets.
11. Bone marrow transplantation is used to treat leukemia, lymphoma, and aplastic anemia.
12. Corneal transplants are the most common and most successful type of transplant next to blood transfusions.
13. Thymus tissue, bone marrow, small bowel tissue, knee joints, pancreatic islets, and eyes are needed for ongoing research.

Section 3: Follow-up Activities

Extra Help

1. a. (9) d. (7) g. (2)
b. (6) e. (8) h. (5)
c. (3) f. (4) i. (1)
2. a. E c. E e. I
b. I d. I
- 3.



4.

	VOLUME OF LUNGS	PRESSURE IN LUNGS	MOVEMENT OF RIB CAGE	MOVEMENT OF DIAPHRAGM
Inhalation	increased	decreased	out	down
Exhalation	decreased	increased	in	up

Enrichment

1. *One-Minute Readings* is written by Richard F. Brinckerhoff and published by Addison-Wesley Publishing Company, 1992.
2.

Tidal volume	500 mL
Expiratory reserve volume	1000 mL
Inspiratory reserve volume	3500 mL
Vital capacity	5000 mL
Residual volume	1000 mL
3. Ask how equipment replaces the mechanics of breathing.
4. They are very willing to send out pamphlets and posters. Remember to write a thank-you letter.
5. Mention that you are studying a lesson through ADLC on organ and tissue donation.



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